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Advanced Integrated Multi-sensor Surveillance (AIMS)

Mission, Function, Task Analysis

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Contract Number: W7711-4-7904/01-TOR

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Defence R&D Canada – Atlantic

Contract Report
DRDC Atlantic CR 2007-021
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Canada

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Contract Report

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June 2007

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Abstract

To increase the effectiveness of searching, detecting, classifying, and identifying contacts particularly at night and in poor weather, the Advanced Integrated Multi-sensor Surveillance (AIMS) system is being developed. The AIMS system is advanced through the integration of four sensors into a single gimbal. As such, the system will support a myriad of missions for both the CP-140 and Fixed Wing Search and Rescue (FWSAR) communities, including timely search and rescue (SAR) response, maritime operations, and ground surveillance in support of the Land Forces (LF). To ensure optimal performance, the AIMS system requires an appropriate interface and controls, the design of which must provide effective interaction between the operator and the technological capability of the system. This document, prepared by CAE Professional Services on behalf of Defence R&D Canada (DRDC), presents results stemming from the mission, function, and task analysis of the activities associated with employing the AIMS system on the FWSAR and AIMP CP-140 platforms to support the conduct of SAR and ground surveillance missions respectively. This data will be used to support the design of an Operator Machine Interface (OMI) for the AIMS system.

Résumé

Le système perfectionné de surveillance multi-capteurs intégré (AIMS) est mis au point dans le but d'accroître l'efficacité de la recherche, de la détection, de la classification et de l'identification des contacts, en particulier la nuit et dans de mauvaises conditions météorologiques. Il s’agit d’un système évolué fondé sur l'intégration de quatre capteurs dans un seul cardan. Il contribuera à toute une gamme de missions du CP-140 et de l'aéronef à voilure fixe pour la recherche et sauvetage (FWSAR), y compris l'intervention de recherche et sauvetage (SAR) en temps opportun, les opérations maritimes et la surveillance au sol à l'appui de la Force terrestre (FT). Dans le but d'optimiser la performance, le système AIMS a besoin d'une interface et de commandes appropriées, dont la conception doit permettre une interaction efficace entre l'opérateur et la capacité technique du système. Le présent document, préparé par CAE Services professionnels au nom de R & D pour la défense Canada (RDDC), présente les résultats d'une analyse de missions, de fonctions et de tâches (MFTA) des activités associées à l'emploi du système AIMS à bord du FWSAR et de la plate-forme CP-140 du Programme de modernisation progressive de l'Aurora (PIMPA) à l'appui de la conduite d'opérations SAR et de missions de surveillance au sol. Ces données viendront à l'appui de la conception d'une interface opérateur-machine (IOM) pour le système AIMS.

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Executive summary

Introduction

To increase the effectiveness of the searching for, detecting, classifying, and identifying contacts particularly at night and in poor weather, the Advanced Integrated Multi-sensor Surveillance (AIMS) system is being developed. Superseding earlier versions of the technology (the Airborne Laser Based Enhanced Detection and Observation System (ALBEDOS), and the Enhanced Low-Light Level Visible and InfraRed Surveillance System (ELVISS)), the AIMS system provides advances through the integration of four sensors into a single gimbal. The system will support missions for both the CP-140 and Fixed Wing Search and Rescue (FWSAR) communities including timely search and rescue (SAR) response, maritime operations, and ground surveillance in support of the Land Forces (LF).

Operator-machine interface (OMI) design concepts for controlling the AIMS system were developed under contract to CAE Professional Services (PS) (formerly Greenley and Associates Inc.). As part of the design process, a detailed mission, function and task analysis (MFTA) was conducted. The analysis focused on the major mission phases and functions, the timescale of activities, and external events which influence operation of the AIMS system. Previous analyses were used as a foundation with the current project extending the results by focusing on the integration of the AIMS system onboard the two aforementioned aircrafts. The objective of this document is to report the results from the MFTA of the activities involved in using the AIMS system to support the conduct of SAR, maritime, and ground surveillance missions.

Results

Results of the mission analysis include a summary of each current platform, roles and missions, crew composition, and air vehicle characteristics. The function analysis provides a brief description of pertinent higher level functions, with emphasis on employing the Electro Optical (EO)/Infrared (IR) system, as well as function inventories and function flow diagrams. The task analysis focused on those tasks that would be specific to the operation of the AIMS system in support of higher level mission functions. These tasks formed the operational requirements for the design of the AIMS operator-machine interface (OMI).

Conclusions

These analyses have updated the database of human factors information with respect to mission characteristics and use of current EO/IR systems on FWSAR and AIMP CP-140 aircraft. The AIMS system on the FWSAR and/or CP-140 aircraft is expected to be used across a wide range of missions and the information obtained through the analyses is particularly important for ensuring that the design of the AIMS OMI optimizes operator performance.

Military Significance

The integration of the AIMS system onboard the FWSAR and CP-140 aircraft is expected to be used across a wide range of missions. Despite the variation in missions between the FWSAR and CP-140 there is significant commonality with respect to employment of the current EO/IR system. Results of this task analysis are particularly important for ensuring that the usability associated with the AIMS OMI design is compatible with the anticipated usage of the AIMS system by the primary operators. It is recommended that they be considered during the integration of the AIMS system as part of the FWSAR and AIMP CP-140 projects.

Baker, K. and Youngson, G. 2007. Advanced Integrated Multi-sensor Surveillance (AIMS) Mission Function Task Analysis. DRDC Atlantic CR 2007-021. Defence R&D Canada - Atlantic.

Sommaire

Introduction

Le système perfectionné de surveillance multi-capteurs intégré (AIMS) est mis au point dans le but d'accroître l'efficacité de la recherche, de la détection, de la classification et de l'identification des contacts, en particulier la nuit et dans de mauvaises conditions météorologiques. Appelé à remplacer des versions antérieures de la technologie (le système laser aéroporté perfectionné de détection et d'observation [ALBEDOS] et le système perfectionné de surveillance à intensification de lumière visible et à infrarouge [ELVISS]), le système évolué AIMS est fondé sur l'intégration de quatre capteurs dans un seul cardan. Il contribuera aux missions du CP-140 et de l'aéronef à voilure fixe pour la recherche et sauvetage (FWSAR), y compris l'intervention de recherche et sauvetage (SAR) en temps opportun, les opérations maritimes et la surveillance au sol à l'appui de la Force terrestre (FT).

Les principes de conception de l'interface opérateur-machine (IOM) en vue de la commande du système AIMS ont été mis au point en vertu d'un marché adjugé à CAE Services professionnels (nouvelle appellation de Greenley and Associates Inc.). Dans le cadre de la conception, une analyse détaillée de missions, de fonctions et de tâches (MFTA) a été menée. Elle a porté essentiellement sur les principales fonctions et phases des missions, la durée des activités et les événements externes qui influent sur le fonctionnement du système AIMS. Des analyses antérieures ont servi de fondement, le projet en cours élargissant les résultats en mettant l'accent sur l'intégration du système AIMS à bord des deux aéronefs susmentionnés. L'objectif du présent document est la présentation des résultats de la MFTA des activités associées à l'utilisation du système AIMS à l'appui de la conduite d'interventions SAR, de missions maritimes et de la surveillance au sol.

Résultats

Les résultats de l'analyse de missions comprennent un sommaire pour chaque plate-forme utilisée, les rôles, les missions, la composition des équipages et les caractéristiques des véhicules aériens. L'analyse de fonctions donne une brève description des fonctions de haut niveau pertinentes, qui met l'accent sur l'emploi du système électro-optique (EO)/infrarouge (IR), ainsi que des inventaires des fonctions et les diagrammes des fonctions. L'analyse de tâches a porté sur les tâches propres au fonctionnement du système AIMS à l'appui des fonctions de mission de haut niveau. Ces tâches ont formé les exigences opérationnelles de la conception de l'IOM du système AIMS.

Portée

Les analyses ont permis de mettre à jour la base de données sur les facteurs humains en ce qui concerne les caractéristiques des missions et l'utilisation des systèmes EO/IR

en place à bord du FWSAR et du CP-140 du Programme de modernisation progressive de l'Aurora (PIMPA). On s'attend à ce que le système AIMS à bord du FWSAR ou du CP-140 soit utilisé dans toute une gamme de missions, et les données obtenues grâce aux analyses sont particulièrement importantes pour garantir que la conception de l'IOM du système AIMS permettra d'optimiser la performance de l'opérateur.

Applications militaires

On s'attend à ce que le système AIMS intégré à bord du FWSAR et du CP-140 soit utilisé dans toute une gamme de missions. Malgré les différences entre les missions rattachées au FWSAR et celles qui sont liées au CP-140, il y a une importante communalité en ce qui concerne l'emploi du système EO/IR en place. Les résultats de cette analyse de tâches sont particulièrement importants pour garantir que la convivialité de la conception de l'IOM du système AIMS est compatible avec l'usage anticipé du système AIMS par les principaux opérateurs. Il est recommandé d'en tenir compte durant l'intégration du système AIMS aux projets du FWSAR et du CP-140 du PIMPA.

Baker, K. and Youngson, G. 2007. Advanced Integrated Multi-sensor Surveillance (AIMS) Mission Function Task Analysis. DRDC Atlantic CR 2007-021. Defence R&D Canada - Atlantic.

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1. Introduction

1.1 Background

To increase the capability of searching, detecting, classifying, and identifying contacts particularly at night and in poor weather, the Advanced Integrated Multi-sensor Surveillance (AIMS) system is being developed. Earlier versions of AIMS were the Airborne Laser Based Enhanced Detection and Observation System (ALBEDOS), and the Enhanced Low-Light Level Visible and InfraRed Surveillance System (ELVISS). The AIMS system is advanced through the integration of four sensors with active gated capability into a single gimbal. As such, the system will support a myriad of missions for both the CP-140 and Fixed Wing Search and Rescue (FWSAR) communities including timely search and rescue (SAR) response, maritime operations, and ground surveillance in aid of the Land Forces (LF). To ensure optimal performance the AIMS system requires an appropriate interface and controls, the design of which must realize the interaction between technological capability and operator performance.

CAE Professional Services (PS) (formerly Greenley and Associates Inc.) has been contracted to provide human factors research and development support in the development, design, and evaluation of operator interface concepts for controlling the AIMS system.

1.2 Objective

The objective of this document is to outline the results stemming from the mission, function, and task analysis activities associated with employing the AIMS system on the FWSAR and CP-140 (post Aurora Incremental Modernization Program (AIMP)) platforms to support the conduct of SAR, maritime operations, and ground surveillance missions respectively. This data will be used to support the design of an Operator Machine Interface (OMI) for the AIMS system.

1.3 This Document

This section outlines the background and states the objectives of this report. The report outline in this section is intended to show the relationship between the other sections and to guide the reader in finding sections of interest within the document. In addition are the following sections and annexes:

a. Section 2 outlines the methodology utilized to execute the individual analyses that compromise the larger Mission, Function, Task Analysis (MFTA).

b. Section 3 reports the results stemming from the mission analysis for the FWSAR and CP-140 AIMP aircrafts. For each platform, a summary of the current roles

and missions, crew composition, and air vehicle characteristics is discussed. Also, the AIMS system is briefly described. An important part of the mission analysis is the Composite Mission Scenario which is provided in Annex B.

c. Section 4 describes the function analysis including a brief description of pertinent higher level functions (with an emphasis on the employment of an Electro Optical (EO)/Infrared (IR) system) for the FWSAR and CP-140 aircrafts. Detailed results including the function inventories and function flow diagrams are found in Annexes C and D.

d. Section 5 outlines the task analysis findings, focusing on those tasks that are specific to the operation of the AIMS system in support of the higher level mission functions. These tasks form the operational requirements for the design of the AIMS OMI.

e. Section 6 summarizes the conclusions drawn from the completion of the AIMS MFTA.

f. Section 7 provides a list of pertinent resources used in the generation of this document.

g. Annex A presents the three scenarios for the CP-140 AIMP. Similar scenarios for the FWSAR aircraft are contained in the Statement of Operating Intent (SOI) for the FWSAR [Reference 3] and have not been included in this document.

h. Annex B lists the functions for both the FWSAR and CP-140 AIMP aircraft. Given the focus on the AIMS system integration in the platforms only those functions related to the operation of the AIMS system are presented in this annex.

i. Annex C illustrates the Function Flow Diagrams (FFD) for the FWSAR and CP-140 AIMP aircrafts. Similar to Annex B, the selection of FFDs for presentation in this report was tailored to the objective of the AIMS Human Factors Engineering (HFE) analysis.

j. Annex D provides the task data sheets for each one of the AIMS-specific tasks.

2. Methodology

2.1 General

Section 2 provides an overview of the methodology used for the human engineering analysis supporting the integration of the AIMS system in the FWSAR and CP-140 AIMP aircrafts. The analysis complies with MIL-HDBK-46855A [Reference 1] for conducting Mission, Function and Task Analyses.

NOTE: Since the creation of this report, the AIMS system configuration has changed—the AGTV WFOV has been substituted with a laser rangefinder. The following system description reflects the AIMS system configuration at the time of writing this report (i.e. no laser rangefinder).

NOTE: The associated OMI Definition Study (DRDC Atlantic CR 2006-042, Advanced Integrated Multi-sensor Surveillance (AIMS): Operator Machine Interface (OMI) Definition Study) incorrectly refers to substitution of the colour WFOV camera for the laser rangefinder.

2.2 Mission Analysis

2.2.1 General

A detailed Mission Analysis was conducted of the FWSAR and CP-140 AIMP to describe the roles, missions, organization, personnel, equipment and other relevant information associated with the AIMS implementation. The objective of this analysis was to provide information that defines the missions of the AIMS system, and the environment and circumstances in which these missions must be conducted. In accomplishing this, each distinct event in the mission from the point at which human interaction with the system commences until human interaction terminates was considered. The analysis focused on the major mission phases and functions, the timescale of activities, and external events which influence the activities of the system. In this respect, the Mission Analysis is an essential prerequisite for subsequent HFE analysis activities that were conducted during this study, including identification and analysis of tasks.

2.2.2 Methodology

A two-part methodology was executed to support the completion of the mission analysis for each aircraft. First, an extensive data collection exercise was conducted to generate a foundation of knowledge to support the mission analysis. Specifically, the following documents were reviewed for both aircraft:

a. **FWSAR.** This included relevant SAR-related documentation [References 25, 26]; FWSAR project documentation such as the Statement of Intent [Reference 5] and Statement of Requirements (SOR) [References 4]; and FWSAR HFE studies [Reference 6].

b. **CP-140 AIMP.** This included pertinent AIMP project documentation [References 7, 8]; CP-140 concept of operations [Reference 11] as well as predecessor HFE studies on the CP-140 [References 9, 10].

Building upon these previous mission descriptions and environmental factors discussion, the crew composition, the operational concept, and system description were developed for the AIMS system. Applicable excerpts from these documents have been included in this document for quick reference and completeness.

On-going communications with the operational community was established and maintained in order to determine the differences between current operational techniques and the future proposed operations using AIMS. Specifically, the FWSAR PMO in Ottawa, Ontario and the Maritime Proving and Evaluation Unit (MP&EU) at Canadian Forces Base (CFB) Greenwood, Nova Scotia were consulted for this effort.

The Mission Analysis also includes a series of mission scenarios for each aircraft. The scenarios represent operational missions that are relevant to the AIMS system. The reason for using the scenarios is twofold: first, to focus the analysis on mission sequences that are likely to be critical to requirements definition and the design of the OMI; and second, to avoid wasting effort by analyzing functions that have already been analyzed, are unlikely to be critical to overall system performance, or are unlikely to provide any added value. The scenarios are also helpful for a quick understanding of the FWSAR and CP-140 missions, but they are limited in scope.

2.3 Function Analysis

2.3.1 General

At the highest (top) level, the functional decomposition describes FWSAR and CP-140 missions as performed by the total system without distinguishing whether functions are performed by the crew or by the aircraft systems. Missions are addressed as distinct segments, each segment having its own discrete hierarchy of functions, but related to each other in a logical and chronological sequence.

To support the conduct of the AIMS function analysis, Reference 6 has been leveraged for the FWSAR functional decomposition. For the CP-140, previous CP-140 documentation [References 9 and 10] has been augmented and extended with HFE analyses conducted on similar aircraft; specifically

the Canadian Forces (CF) SAR helicopter [Reference 23] and Coastal Patrol Aircraft [Reference 24] to address the requirements for the AIMS system.

2.3.2 Methodology

The objective of a function analysis is to identify the functions (and sequence of functions) that must be performed by the system being analyzed to achieve mission objectives. Successive decomposition of functions involves a functional decomposition of the missions from top-level functions down to 'n'-level functions. The decomposition will yield an inventory of functions in a nested order such that the hierarchy is captured. That is, following each top-level function, all related first-level functions are listed, and between each first-level functions, all the second-level functions associated with the first-level function are listed, and so on through the function list. The lowest level is also referred to as the task level, whereby a task is defined as a specific human activity with a unique set of performance characteristics. The function analysis utilizes the results of the mission analysis, and provides the basis for the subsequent task analysis.

The reason for applying such a rigorous process to the function analysis is simply to minimize the possibility of missing any functions that could be critical in analyzing system requirements.

The mission segment descriptions (Section 4.3 through Section 4.6) provide the only prose that gives a detailed explanation of the system functionality required for each of the mission segments. This is a valuable source of information for all newcomers to the project whether they are analysts, system designers or users, and it can be an important reference for later use. Through this process, the analysts gain a comprehensive understanding of the pertinent missions from this initial exploration of the mission segments. The lengthy inventory of functions located in Annex B is more difficult to read and is unlikely to be useful for obtaining general overview of the mission segments.

Inventory of Functions

Annex B contains a hierarchical inventory of FWSAR and CP-140 AIMP functions pertinent to the subsequent analysis of the AIMS tasks. As such, this document does not present a comprehensive list of all functions for each individual top-level function. First-level functions that do not include interactions with the AIMS system were not decomposed to a lower level.

The Function Flow Diagrams in Annex C indicate the interrelationship of these functions.

Function Flow Diagrams

The functions in the top, first and second levels were arranged in function flow diagrams to indicate their relationship with one another, within their levels. The top-level functions are arranged in chronological order from departure through to arrival, transitioning through the different mission segments. For each top-level function there is a list of associated first-level functions, and these were similarly arranged chronologically and logically. The simple logical connectors ‘AND’ and ‘OR’ were used to indicate whether a group of functions must be performed together to complete the mission (AND), or if only one of a list of functions may be performed at a particular juncture in the mission (OR). In addition, AND/OR connectors were used when the mission may include two or more functions in parallel, or only one of the functions. These connectors allow the analyst to simulate tactical decision making and allow for the introduction of external stimuli that affect the course of the mission.

The FFDs for the Top, First, and Second level functions are included with the applicable mission section descriptions in Section 4. In addition, the FFDs associated with the Top, First, and Second level functions are provided in Annex C. Similar to the inventory of functions, the FFDs presented in this document were limited to those representing utilization of the AIMS system within an operational context.

2.4 Task Analysis

2.4.1 General

The primary objective of a Task Analysis is to develop a database of task-related information to support the analysis of the AIMS system and the establishment of a baseline for developing OMI requirements. This information is also beneficial to various other activities including system design and specification, user evaluations, system acceptance, and training development.

2.4.2 Methodology

Using the Task Inventory and task descriptions from the Function Analysis, CAE PS completed a detailed analysis of those tasks specific to the operation of the AIMS system within the various FWSAR and AIMP missions. As such, the task list leveraged the existing ELVISS task analysis as documented in Reference 17. Specifically, the ELVISS tasks were updated and extended to address new AIMS functionality and lessons learned from the previous studies. A review of these tasks was conducted with the AIMS project team to ensure completeness and accuracy.

A database was developed using TaskArchitect™ to capture task data elements for each unique task and then used to support the establishment of requirements for the operator interface. The task analysis results are represented in data sheets that are resident in Annex D.

3. Mission Analysis

3.1 General

The objective of the Mission Analysis is to document the roles and missions of the FWSAR and CP-140 aircrafts as well as provide a brief description of the aircrafts focusing on their crew composition and pertinent systems (e.g. navigation, communication, sensor). In addition, the mission analysis will describe the AIMS system and culminate in creation of mission scenarios articulating a sample of sorties by each aircraft. The conduct of a Mission Analysis is the first step in the subsequent identification and analysis of the functions related to the integration of the AIMS system onboard each aircraft.

3.2 FWSAR Aircraft

The mission analysis for the FWSAR aircraft is comprised of the following sections:

a. Canadian Search and Rescue Programs;

b. Canadian Search and Rescue Coordination;

c. Defence Search and Rescue Policy;

d. CF SAR Roles and Missions;

e. FWSAR Roles and Missions;

f. FWSAR Crew Composition; and

g. FWSAR Air Vehicle Characteristics.

3.2.1 Canadian Search and Rescue Programs

In Canada, the federal and provincial/territorial governments have statutory responsibility for the conduct of search and rescue within their own jurisdictions. Collectively, these responsibilities make up the National Search and Rescue Program (NSP) [Reference 25]. Further cooperation agreements with municipalities and numerous non-government SAR organizations set out additional SAR Response and SAR Prevention activities for these organizations. The federal government’s collective SAR activities make up the Federal Search and Rescue Program (FSP) [Reference 26], which involves close linkages among six federal department partners.

The objective of SAR programs is to save lives by minimizing the number of people who get into distress, and providing effective response services.

National Search and Rescue Program

The NSP is the collection of SAR services provided by all agencies and individuals in Canada, regardless of the type of activity or jurisdiction. The primary goal of the NSP is to save lives at risk throughout Canada via a collaborative effort involving federal departments, volunteers, organizations, municipalities, provinces, and territories. The NSP focuses on the achievement of a seamless SAR system in Canada as articulated in a Vision Statement and two Objectives [Reference 25]:

a. **SAR Vision Statement.** A Canada where the critical importance of Search and Rescue is reflected in a multi-jurisdictional approach to promoting individual, collective and organizational behaviour that minimizes the risk of injury or loss of life while maintaining timely and effective response services.

b. **SAR Response Objective.** To ensure an effective SAR response (capability) in all areas of Canada.

c. **SAR Prevention Objective.** To educate individuals and organizations on the assessment of risks and the importance of acquiring and using the knowledge, skills and equipment needed to minimize injury and/or loss of life.

Federal Search and Rescue Program

The FSP consists of the individual and collective activities of the federal government departments and agencies having either primary or secondary roles and responsibilities with respect to the provision of SAR services in the federal mandate areas of Canada's search and rescue areas of responsibility. The FSP Program Plan [Reference 26] provides guidance and direction to the collective activities of the six federal government departments participating in the FSP. Departments and/or their agencies or components delivering SAR services are responsible to Government both for the individual departmental activities and for participation in and support of collective Program level initiatives.

Management of the FSP is conducted through the following parties:

a. **Lead Minister for SAR (LM-SAR).** In 1976, the Prime Minister appointed the Minister of National Defence as the Lead Minister for SAR. The LM-SAR is responsible for the co-ordination of the NSP and the development of national SAR policies in conjunction with other Ministers. The LM-SAR is the designated national spokesperson and

responsible for ensuring that the national SAR system operates effectively.

b. **National Search and Rescue Secretariat (NSS).** The NSS is an independent government agency providing support and advice to the LM-SAR. Established in 1986, the NSS supports and promotes the NSP activities as a means to achieve effective and economically responsible SAR programs throughout Canada. Related to federal jurisdiction, the NSS is responsible for the development, coordination, analysis, and review of FSP policies, plans, and activities. The NSS also works directly with provincial and territorial SAR authorities and police services to develop and standardize the quantity and quality of SAR services. The NSS enhances the coordination between provincial/territorial SAR programs and the federal program.

   The NSS coordinates the Canadian contribution to the Cosmicheskaya Sistyema Poiska Avariynich Sudov (COSPAS) – Search and Rescue Satellite-Aided Tracking (SARSAT) satellite alerting system, and it monitors the standards and maintains the Canadian registry for personal locator beacons. Finally, a New SAR Initiatives Fund (NIF), which provides annual funding for new projects (or initiatives) to improve the NSP, is managed by the Secretariat on behalf of the LM-SAR.

c. **Interdepartmental Committee on Search and Rescue (ICSAR).** Established in 1976, ICSAR ensures the national co-ordination and delivery of SAR services. ICSAR is responsible for identifying SAR requirements and providing advice on how the government can best respond to these requirements. Membership at ICSAR includes senior representation from the six primary federal SAR delivery departments and is chaired by the Executive Director of the NSS.

Federal SAR Delivery Departments

Six federal departments and agencies are involved in SAR response and prevention activities:

a. **Department of National Defence (DND).** DND delivers primary air SAR services for both aeronautical and maritime incidents; provides a high level of secondary SAR support from its aircraft; and, co-ordinates the activities of volunteer SAR organizations.

b. **Department of Fisheries and Oceans (Canadian Coast Guard).** Canadian Coast Guard **(**CCG) has primary responsibility for the provision of the maritime component of the FSP and for all matters relating to pleasure craft safety. CCG SAR tasks include the detection of maritime incidents and with the assistance of DND, the co-ordination, control and conduct of SAR operations in maritime SAR situations; the provision of

maritime resources to help with aeronautical SAR operations; and the provision of SAR resources to assist in humanitarian and civil incidents.

c. **Environment Canada (Meteorological Service of Canada).** The Meteorological Service of Canada provides information on climate, weather, ice and other environmental issues of particular interest to the SAR community.

d. **Public Safety and Emergency Preparedness (Royal Canadian Mounted Police).** In designated areas, the Royal Canadian Mounted Police (RCMP) responds to SAR incidents. RCMP SAR Coordinators ensure that regional issues, including policy, training and resources are addressed. Detachment Commanders ensure that complaints of lost or overdue persons are promptly investigated. When warranted, a SAR trained RCMP Search Commander is appointed and assumes overall on-site authority for the organization and management of the actual search.

e. **Parks Canada Agency.** Parks Canada provides SAR services within national parks, national marine conservation areas and reserves, national historic sites and historic canals.

f. **Transport Canada (Aviation).** Transport Canada is responsible for the provision of the aeronautical SAR prevention program as well as the means and methods to support civil aircraft in distress.

Each province and territory has its own SAR system, which can involve provincial police, the RCMP, volunteer associations and municipalities. Hundreds of skilled groups across Canada, many of them volunteers, are active in ground, air, and marine SAR.

Volunteer SAR Organizations

A key element of responsible use of SAR resources has been a growing emphasis on SAR prevention activity. However, SAR prevention is, to a large extent, dependant on volunteer participation, and is subject to pressure from demographic change, as well as from constrained finances of the public sector. The primary national voluntary organizations are the Civil Air Search and Rescue Association (CASARA) and the Canadian Coast Guard Auxiliary (CCGA).

3.2.2 Canadian Search and Rescue Coordination

Canadian Search and Rescue Regions

To prosecute SAR events efficiently, Canada is divided into three Search and Rescue Regions (SRRs): Victoria, Trenton, and Halifax (Figure 1).

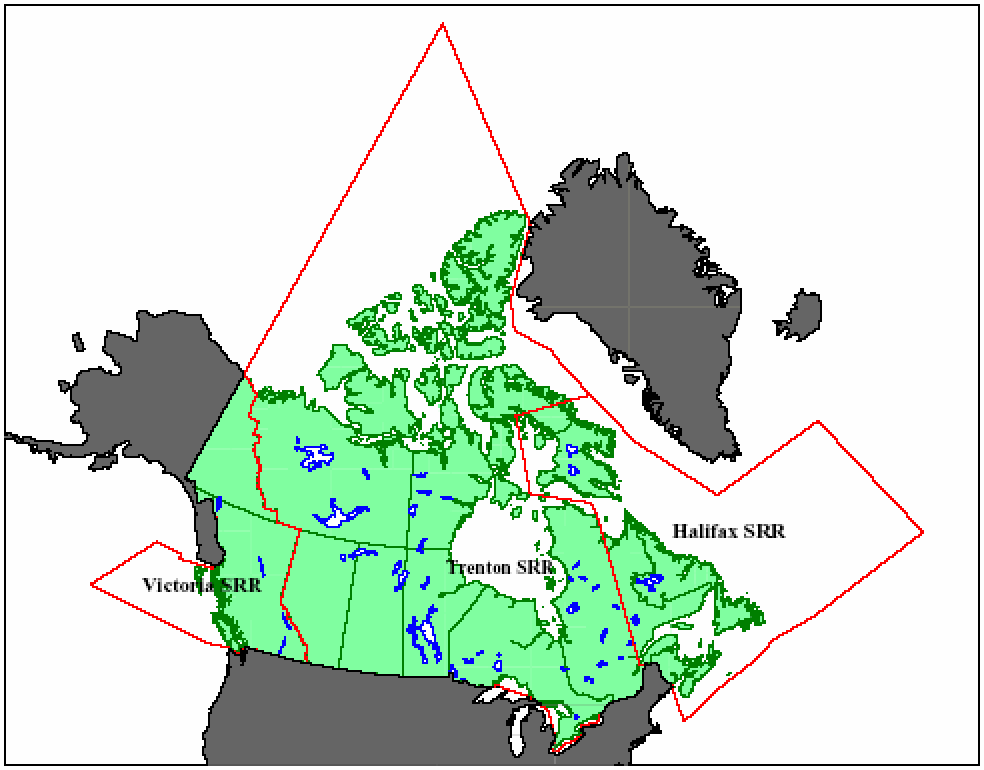

Figure 1. *Canadian Search and Rescue Regions [Reference 25]*

Joint Rescue Co-ordination Centres (JRCC) and Maritime Rescue Sub-Centres (MRSCs) have been established to coordinate, control, and conduct SAR operations within the region of responsibility.

a. **Joint Rescue Co-ordination Centres.** Three JRCCs (Victoria BC, Trenton ON, and Halifax NS) operate continuously to coordinate maritime and aeronautical SAR in their respective SRR. As a secondary role, JRCCs facilitate requests from other levels of government for federal SAR resources to assist with incidents that fall within provincial or municipal jurisdiction. JRCCs are staffed by two Maritime Coordinators (CCG officers) and an Aeronautical Coordinator (Air Force pilot or navigator). Co-located with JRCC-Trenton, the Canadian Mission Control Centre is the focal point for the receipt of distress beacon messages from national and international sources in accordance with procedures prescribed in national agreements and the COSPAS–SARSAT documentation.

b. **Maritime Rescue Sub-Centres.** To assist JRCC-Halifax, MRSC Laurentians (Quebec City) and MRSC Newfoundland (St. John's) are located within Halifax's area of responsibility. Staffed by Coast Guard

personnel, the objective of a MRSC is to reduce the JRCC's workload in areas of high marine activity. Specifically, each MRSC coordinates marine SAR activities and assists with aeronautical SAR activities within their respective areas of responsibility.

Response to SAR Categories

Search and rescue falls into three natural categories: marine, aeronautical, and ground. The categories overlap to some extent, but there are differences in the types of SAR skills and equipment needed. Response to SAR incidents is dependent on the category as described below:

a. Marine SAR refers to activities within Canada's oceanic area of responsibility as well as the St. Lawrence Seaway and the Great Lakes. Response to marine SAR is managed by the federal government through the JRCCs and MRSCs. Marine SAR operations are carried out by the CCG and CCGA vessels as well as CF aircraft.

b. Aeronautical SAR covers any type of search for aircraft, over land or water. Response to this type of SAR incident is coordinated by the three JRCCs and will involve CF aircrafts. Aeronautical SAR operations are also carried out by CASARA aircraft and by CCG/CCGA when a missing aircraft's route includes portions over water.

c. Ground SAR services, such as locating lost, missing or distressed persons on the ground, are provided by provincial/territorial government organizations. This includes searches on inland waters such as lakes and rivers outside National Parks. In most cases, ground and inland water programs are managed by provincial or territorial emergency measures organizations, with search and rescue operations carried out by police, emergency services personnel and an extensive network of skilled volunteers.

Under the SAR program, DND and the CCG co-ordinate the response to aeronautical and maritime SAR incidents through jointly staffed Rescue Co-ordination Centres. Any SAR incident begins with a distress call to either one of the JRCCs or one MRSCs staffed by Coast Guard personnel.

3.2.3 Defence Search and Rescue Policy

International Agreements

Canada participates with the world wide community in providing SAR services. Canada contributes to international organizations including the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO). In addition, Canada has agreed to adopt SAR standards and practices compliant with the Convention on International Civil

Aviation, the International Convention on Maritime Search and Rescue, and the International Convention for the Safety of Life at Sea (SOLAS). Standardization is also achieved through membership in international military organizations such as the North Atlantic Treaty Organization (NATO) and the Air Standardization Coordinating Committee. Finally, as a member of COSPAS-SARSAT, Canada operationally monitors SAR satellites.

National Search and Rescue Objective

The National SAR objective as defined in the National SAR Manual [Reference 24] is to prevent loss of life and injury:

a. through search and rescue alerting, responding and aiding activities which use public and private resources, including where possible and directly related thereto, reasonable efforts to minimize damage to or loss of property; and

b. by ensuring appropriate priority to aviation and marine safety and prevention measures focused on owners and operators most commonly involved in SAR incidents.

The Canadian area of responsibility identified in the National SAR Manual for aeronautical search and rescue is as defined under ICAO agreements, and for marine search and rescue is as defined under IMO agreements, and includes Canadian waters of the Great Lakes and the St. Lawrence system. The National SAR Manual [Reference 25] is issued under the joint authority of the Deputy Minister of National Defence, the Chief of Defence Staff and the Commissioner of the Canadian Coast Guard.

3.2.4 CF SAR Roles and Missions

The 1994 White Paper on Defence [Reference 28] outlines the strategic-level roles that have been identified for the CF with the intention of providing clear direction for the CF. Related to the defence of Canada (and Canadians) and the protection of Canadian sovereignty is the provision of SAR support. The CF contributes to the maintenance and operation of Canada's search and rescue capability. Specifically, the CF is responsible for:

a. aeronautical SAR capabilities;

b. providing significant resources (e.g. manpower, Command and Control facilities) to assist the Coast Guard with marine SAR;

c. assisting local authorities in ground SAR operations; and

d. operating three JRCCs.

The National SAR Manual [Reference 25] further decomposes the CF SAR role into the following primary SAR tasks within the Canadian SAR area:

a. to co-ordinate, control and conduct SAR operations in relation to aeronautical SAR incidents within the Canadian area of responsibility;

b. to provide search and rescue units (SRUs) in support of the prosecution of maritime SAR operations and to exercise ultimate authority in the allocation of all SRUs during a SAR incident;

c. to conduct ground searches in relation to aeronautical and maritime SAR incidents; and

d. to provide the resources to operate the Canadian components of the SARSAT system.

Canadian Search and Rescue C2

As the lead government department, DND has primary responsibility for SAR operations within Canada. To that end, SAR responsibilities for each region/RCC have therefore been assigned to military commanders as follows:

a. Commander Maritime Forces Atlantic is commander of the Halifax SRR;

b. Commander 1 Canadian Air Division is commander of the Trenton SRR; and

c. Commander Maritime Forces Pacific is commander of the Victoria SRR.

Additional coordinators (e.g. Searchmaster (SM), On-Scene Commander (OSC), Coordinator Surface Search) may also be appointed by the applicable RCC in response to requirements of individual SAR events.

Primary Aviation SAR Resources

DND's primary aviation SAR response sources are located in CF SAR squadrons across the country. The majority of squadrons possess a dual role whereby they support both SAR and transport missions. The latter is facilitated by the fact that SAR activity rates will vary and there are times when aircraft in these units are available to conduct general transport missions. This additional role is applicable to both peacetime and wartime activities. National defence policies therefore call for SAR aircraft to provided both SAR and transport capabilities. To that end, CF SAR squadrons are designated as Transport and Rescue Squadrons.

Currently, the CF SAR squadrons operate three primary aircraft during the conduct of search and rescue missions: CC-130 Hercules, CC-115 Buffalo, and CH-149 Cormorant. With the introduction of the FWSAR aircraft, the

CF SAR fleet will encompass two primary aircraft, FWSAR and CH-149 Cormorant.

3.2.5 FWSAR Roles and Missions

As defined in the FWSAR SOR [Reference 4], the primary roles for the FWSAR aircraft include:

a. The provision of national and military SAR services in response to aeronautical and maritime incidents;

b. The provision of airlift support for SAR operations;

c. The provision of aeromedical evacuation from arctic and remote areas;

d. The provision of supplemental airlift for operations of national and military interests; and

e. The provision of the capacity of OSC or Coordinator Air Search on behalf of the JRCCs.

Secondary roles for the FWSAR aircraft include providing support to humanitarian and civil incidents where the aircraft would be the most practical resource available.

FWSAR missions are captured in the FWSAR SOR [Reference 4] whereby the role of the aircraft with respect to the 11 Force Planning Scenarios from Defence Plan 2004 [Reference 28] is described.

3.2.6 FWSAR Crew Composition

The FWSAR crew configurations as well as individual responsibilities, training, and prerequisites are captured in the SOR for the FWSAR Project [Reference 4]. Salient points are presented in the following section for completeness.

Crew Configuration

The crew complement for the FWSAR aircraft will vary depending on the objective of the operational tasking. Typical crew configurations are:

a. SAR: 2 pilots, 1 Navigator, 1 Flight Engineer (FE), 2 SAR Technicians;

b. Transport: 2 pilots, 1 FE, 1 Navigator as required;

c. Aeromedical Evacuation: 2 pilots, 1 Navigator, 1 FE, 2 SAR Techs, 2 Aeromedical Evacuation Crew Members (AECMs);

d. Local Pilot Training Flight: 2 pilots (and 1 FE when the aircraft is operating away from its Main Operating Base (MOB)) and others, as required;

e. SAR Training Flight: 2 pilots, 1 Navigator, 1 FE, 2 SAR Techs plus instructors as required; and

f. Ferry/Test Flights: 2 pilots (and 1 FE when the aircraft is operating away from its MOB) and others, as required.

Pilot

The primary responsibility of the FWSAR pilot is to safely operate the aircraft in assigned SAR and domestic airlift roles under day and night all weather conditions as directed by the operational commander. Specific tasks to be undertaken by the FWSAR pilots include:

a. perform pre-flight duties including coordination with JRCC and other supporting agencies, mission planning, weather and Notice to Airmen (NOTAM) evaluation, interpretation and application of aircraft performance data, performing route study, flight planning and crew briefings;

b. perform aircraft start, taxi, take-off, and departure (and similarly aircraft arrival, descent, approach, and landing procedures);

c. perform procedures related to en route aviation, navigation, communication, and aircraft/aircrew management;

d. execute search patterns;

e. perform SAR aerial delivery;

f. conduct area illumination;

g. perform specialty SAR duties such as On-Scene Command, electronic homing, cloud-break procedures, airborne intercept/escort procedures, sea assessment;

h. conduct aeromedical evacuation (Medevac) transportation procedures;

i. perform domestic utility airlift mission procedures;

j. perform crew debrief, debriefing of JRCC/SM and pursue resolution of any aircraft or aircrew requirements arising from completed or subsequent missions; and

k. prepare post-mission documentation on SAR mission execution as well as training documentation on all crewmembers.

In addition, the aircraft pilots have the responsibilities of: Aircraft Commander (AC) or First Officer (FO). The AC is responsible for the safety of both the crew and the aircraft and is accountable to the Squadron Commander to ensure the success of operational mission. The AC also assigns crew duties and ensures their completion. The FO is accountable to the AC for all actions.

Prerequisites for selection to the specialty of pilot include a rank from Lieutenant to Colonel; qualified as a Multi-Engine Medium/Heavy Air Transport Pilot or Multi-Engine Utility Pilot or have completed Multi-Engine Air Force Task Advanced Distributed Learning Network; and employed or selected for employment with SAR squadrons. To learn aircraft-specific technical information and operating procedures, pilots will require Conversion Training to the new FWSAR aircraft. Initial Cadre Training will be provided to train pilots to a basic qualification on the aircraft, including a proficiency check and instrument ticket in accordance with CF or equivalent standards.

Navigator/Sensor Operator (Nav/SensO)

The key tasks of the FWSAR aircraft Nav/SensO include:

a. perform detailed flight mission planning;

b. conduct pre-flight inspections of navigation and sensor station;

c. assist with en route navigation;

d. operate onboard sensors, analyze data, and adjust mission profile to optimize sensor capabilities;

e. operate onboard communication suite and maintain official log;

f. execute OSC duties; and

g. act as safetyman during live para delivery.

Prerequisites for selection to the specialty of Nav/Senso include a rank from Lieutenant to Colonel; qualified Air Navigator Basic; and employed or selected for employment with SAR squadrons. Similar to pilots, Nav/Senso will require Conversion Training to the new FWSAR aircraft in order to learn aircraft-specific technical information and operating procedures, with emphasis on the operation of the sensor package and aircraft navigation systems. This may be followed by operational training; during which, role and mission specific procedures are emphasized.

Flight Engineer

The primary role of the Flight Engineer is related to the maintenance of the aircraft. In support of this objective, the key tasks preformed by the FE include:

a. prepare aircraft for flight, including fuelling, inspections, checks, fault diagnosis and rectification;

b. perform load planning and preparation required for the mission;

c. inspect aircraft cargo handling and delivery systems;

d. perform and/or supervise loading, unloading and securing of cargo;

e. perform ground start and engine run-up duties for operational or maintenance purposes;

f. perform SAR visual spotter duties;

g. operate as secondary sensor suite operator;

h. assist with air dispatch of SAR technicians and/or SAR equipment;

i. perform safety person duties during open door/ramp operations;

j. monitor passengers and cargo during all tasked missions; and

k. perform post-flight inspections, checks, data collection, fault diagnosis, repair and sign for work carried.

Prerequisites for selection to the specialty of FE include a current Aero Medical Training Category B pressurized transport certificate; qualified Flight Engineer Basic; and employed or selected for employment with SAR squadrons. FEs will be provided with training in servicing and first line maintenance requirements of the new FWSAR aircraft including comprehensive systems knowledge. In addition, training will be provided to address procedures associated with appropriate loading, securing, transport, dispatching/dropping and unloading of regular cargo, dangerous cargo and personnel. Specialized training will also be required in the operation of the EO/IR sensor suite. Instructor flight engineer training will also be provided for some CF flight engineers in order to establish a FWSAR FE instructor base in the CF for ongoing operational training.

SAR Technician

As defined in the NSP [Reference 25], the primary role of the SAR Tech is to save lives and reduce human suffering. This is accomplished through the following key tasks:

a. assist in SAR mission planning;

b. ensure aircraft properly equipped to handle all SAR call types and conduct pre-flight inspections of onboard SAR equipment;

c. act as or supervise SAR visual spotters during search activities;

d. rig for airdrop SAR equipment to be dispatched from aircraft;

e. remove/insert para doors for aerial delivery/spotting;

f. dispatch SAR equipment/pyrotechnics;

g. jump from aircraft to carry out a rescue;

h. once on scene, access the site to determine the situation; initiate and maintain medical treatment; sustain the survivors; and evacuate survivors

i. supervise aircraft and ground SAR operations; and

j. conduct necessary post flight checks including replenishment of equipment/supplies; and

SAR Technicians' training will be provided to address the aircraft specific technical information and procedures associated with appropriate loading, securing, transport, in flight rigging, dispatching/dropping and unloading of SAR equipment and SAR personnel in the FWSAR aircraft.

To be selected for SAR Tech training, candidates must hold a minimum rank of Corporal. Following basic training, the SAR Techs are posted directly to an operational squadron. For the next four years they possess team member status, completing further training and On-the-Job Training (OJT) packages on both fixed wing and rotary wing aircraft. They then complete a team leader qualifying course. Once that training is complete, the SAR Tech may be upgraded to team leader status at the discretion of the squadron commanding officer.

Aeromedical Evacuation Crew Member

AECMs will be employed solely on aeromedical evacuations flights with their tasks including the following:

a. assist in mission planning;

b. conduct pre-flight inspections of equipment;

c. provide in-flight medical care to patients; and

d. conduct post flight checks including replenishment of equipment/supplies.

AECM training will be provided to address the aircraft-specific technical information and procedures associated with appropriate loading, securing, transport, and unloading of patients and their equipment in the new FWSAR aircraft.

3.2.7 FWSAR Air Vehicle Characteristics

Upon release of this report, a candidate aircraft had yet to be formally selected for the FWSAR. To that end, the following sections highlight the anticipated capabilities of the FWSAR based on the requirements as stated in the SOR for the FWSAR Project [Reference 4].

Flight Control System

The FWSAR aircraft will be equipped with an automatic flight control system (AFCS). This system will be coupled with the navigation system and controllable by either pilot independently.

Communications System

The communication system on the FWSAR aircraft will support communications with both external entities (e.g. JRCC, CCG, civil/military air traffic control, civil shipping) and internal crewmembers. To address these capabilities, the FWSAR aircraft will be equipped with a complement of radios (High Frequency (HF), Ultra High Frequency (UHF), Very High Frequency (VHF) – Frequency Modulated (FM), U/VHF-Amplitude Modulated (AM)/FM), commercial SATCOM, an intercommunication system (ICS), and public address system.

To support the detection and homing of distress beacon signals of 121.5, 243.0, and 406.025 (COSPAS-SARSAT) MHz, the FWSAR aircraft will also possess a dedicated distress frequency homer.

Navigation Systems

The navigation system on-board the FWSAR aircraft will be comprised of a series of interdependent systems including, but not limited to:

a. VHF Omni-directional Radio (VOR) – performs radio navigation of the aircraft through VOR stations;

b. Distance Measuring Equipment (DME) – a transponder-based radio navigation technology that measures distance by timing the propagation delay of radio signals;

c. Global Positioning System (GPS) – a satellite navigation system that receives broadcasts of precise timing signals by radio from a constellation of more than two dozen GPS satellites. The signals allow the aircraft to accurately determine its location (longitude, latitude, and altitude) in any weather, day or night, anywhere on Earth.

d. Automatic direction finder (ADF) – supports the automated detection of signals to assist with finding the direction of a radio signal.

e. Tactical Air Navigation (TACAN) – provides range and bearing information for civil aviation that is a more accurate version of the VHF VOR/DME system.

f. Instrument Landing System (ILS) – an instrument approach system which provides precise guidance to an aircraft approaching a runway.

g. Identification Friend or Foe (IFF) – identification system that enables the differentiation of friendly aircraft, vehicles, or forces, and to determine their bearing and range; and

h. Flight Management System (FMS) – assists the pilots in navigating and managing the aircraft.

Sensor Systems

There are two primary sensors on the FWSAR aircraft to support the completion of its primary missions,

a. **EO System.** The EO system, comprised of both visible and IR collector systems, is intended to be used as a corroborative sensor to detect, classify, and identify contacts beyond visual range during day and night operations. For all cameras, narrow and wide fields of view are possible and imagery can be recorded. Cameras can be directed by manually steering, automatic sector scan, or automatic tracking of a predetermined geographical point.

b. **Radar.** The FWSAR radar is used to support activities related to search and rescue, navigation, ground mapping, as well as weather detection and avoidance.

3.3 CP-140 Aurora

The mission analysis for the CP-140 is comprised of the following sections:

a. CP-140 Roles and Missions;

b. CP-140 Crew Composition; and

c. CP-140 Air Vehicle Characteristics.

3.3.1 CP-140 Roles and Missions

In general terms, the role of the current CP-140 is to provide long-range surveillance of Canada's ocean frontiers and to counter the threat posed by hostile naval surface and submarine forces in times of peace and war. The AIMP SOR [Reference 8] describes two primary categories of CP-140 missions:

a. **Aircraft Missions Over Water.** Missions over water can be further categorized into Surface Surveillance and Control (SSC) and Subsurface Surveillance and Control (SSSC). With each mission type, the aircraft will search for, detect, localize, track, classify, identify, report in real time, and, if required neutralize surface/sub-surface contacts of interest (COI) in co-operation with other forces in all weather conditions and in daylight and darkness. Of importance, the aircraft will determine whether its search area is devoid of contacts so as to ensure that the area of interest has been sanitized.

   Peacetime missions over water include fisheries patrol (FISHPAT), pollution investigation, SAR, contraband interdiction, and environmental patrols. Wartime mission taking place over water involve supporting allied naval forces (e.g. over the horizon targeting) in response to hostile naval surface forces and submarines.

b. **Aircraft Missions Overland.** Missions conducted by the CP-140 over land involve intelligence, reconnaissance, and surveillance. Post AIMP, it is anticipated that the new sensors, in particular the Imaging Radar, will expand the aircraft employment into the broader strategic role of Intelligence Gathering, Surveillance, and Reconnaissance (ISR) in both the open ocean and littoral regions.

   Peacetime operations overland include sovereignty patrol and investigation missions. In support of wartime operations, the CP-140 will be employed as both a strategic and tactical ISR platform as well as a tactical Anti-Submarine Warfare (ASW) and Anti-Surface Warfare (ASuW) platform, either independently or in support of Canadian and allied/coalition naval and army formations. The shift to littoral and associated overland operations requires that the CP-140 (when employed

on a SSC mission) to search for, detect, localize, track, classify, identify, report in real time, and, if required neutralize surface COIs. Operations of this nature must be completed with a high degree of target discrimination to eliminate collateral damage. Taskings in support of overland operations include [Reference 11]:

1. Tactical support for route surveillance, convoy escort, area surveillance, point surveillance, targeting/artillery spotting, battle damage assessment, forward air controller, communications support/relay, and overland SAR; and

2. Strategic support for pattern of life monitoring, intelligence collection, and mapping support.

The following sections articulate a portion of the aforementioned missions over water and overland in greater detail. This is not intended to represent a comprehensive list of CP-140 missions. The objective is to illustrate the diversity in potential missions that the CP-140 can be tasked to perform.

Search and Rescue

The CP-140 will assist primary SAR assets with search and rescues efforts over water and land. The CP-140 involvement may be initiated by two ways:

a. The CP-140 may be deployed from home base or diverted from its current mission by the tasking authority (i.e. JRCC). In the event an Electronic Locator Transmitter/Personal Locator Beacon (ELT/PLB) transmission is received by the JRCC, the CP-140 will be sent to a specific area. If only the general area of the distressed party is known (e.g., an overdue aircraft or vessel) the CP-140 will be provided a larger area or an intended track to search. Typically, the initial search will be a high-altitude electronic sweep of the area or track, followed by an appropriate search pattern using radar, EO, visual and electronic sensors at a lower altitude.

b. A SAR mission may also be initiated if the CP-140 detects an ELT transmission or intercepts a distress call while conducting another mission. The search will then proceed in a similar manner as previously described.

The CP-140 does not possess the capability to deploy survival equipment or visual search aids such as smoke markers or flares. Instead, the CP-140 will remain in sensor contact with the COI until other assets can be directed to perform a rescue.

Fisheries Patrol

One of the most common missions performed by the CP-140 is surveillance of Canadian territorial waters. The CP-140 is regularly tasked to conduct surveillance of specific areas off both the east and west coasts of Canada for fishing activity. Inside of the 200 nm limit, the CP-140 will search for vessels fishing within unlicensed or unauthorized areas. The purpose of performing fisheries patrols is to facilitate resource management by assessing fishing activity in a given area and to act as a deterrent to unauthorized fishing through prosecution of violators.

The aircraft is tasked to patrol specified areas sometimes in conjunction with Navy, Coast Guard, and Department of Fisheries and Oceans (DFO) assets. During a patrol, the aircraft monitors the merchant and fishing vessel traffic in the assigned area, recording the name, home port, position, and activity of each vessel. Fishing vessels are checked for a valid license. Fishing and pollution violations are documented and reported, and, if a supporting vessel is available, it is directed to the scene to assist in prosecuting a violator. Accurate and detailed information is critical for a successful prosecution.

Pollution Investigation

Pollution investigation typically occurs as a result of a chance encounter with pollution during another surveillance task. However, the CP-140 could be tasked to investigate and monitor a known pollution incident, such as a ship breaking up or an oil platform accident. Following the detection of pollution, the CP-140 will record the scope of the affected area and will attempt to locate the source of the pollution. If the source is located, it will be identified and visual evidence linking the source to the pollution will be recorded. Detection and identification of contacts suspected of polluting will be carried out in the same manner as for fisheries patrols.

Contraband Interdiction

Contraband interdiction covers the deterrence of illegal immigration, drug smuggling, weapons smuggling, and any other types of controlled contraband. The CP-140 may be tasked to conduct a contraband interdiction mission or may simply encounter suspect vessels while on an unrelated mission. A report may be initiated when a vessel is detected which becomes suspect, either by virtue of its actions or by a match of its registry to an entry in a database of COIs. The CP-140 will be operated so as not to reveal unusual interest in the suspect vessel.

a. **Shadow Suspect Aircraft.** An air-to-air interdiction will be initiated by North American Aerospace Defense Command (NORAD) operations through the tasking authority. If vectored to intercept a suspect aircraft, the CP-140 will establish a covert stern chase and will maintain

continuous contact through radar, IFF/Selective Identification Feature (SIF) interrogator, EO, or visual means. The CP-140 will record pertinent information such as the target type, registration, markings, altitude, course, speed, position, time and SIF code. Any significant activity, such as the dropping of objects from the suspect aircraft, will be recorded with position noted, and a report will be made to the controlling authority and supporting assets. The CP-140 may be required to communicate with the suspect aircraft and direct a landing. Compliance by the aircraft will require the CP-140 to observe and record the landing site and report any significant activity. Otherwise, the CP-140 will follow the aircraft until Prudent Limit of Endurance (PLE)[1], relieved, or the suspect aircraft lands, at which point the CP-140 will monitor the landing site and report significant activity. The CP-140 will continue to monitor covertly the landing site until PLE or relief arrives. The CP-140 will assist other assets (e.g. police) to find the landing site and the suspects. Any activity that appears to involve transporting the contraband and/or suspects away from the landing site will be noted and recorded by the CP-140.

b. **Shadow Suspect Surface Vessels.** The policing authority will recommend a search area for the CP-140 to locate, identify, track and report a specific COI. The CP-140 will proceed to the expected location and the COI will be located with radar or EO sensors. Next, identification will be accomplished from a distance through EO observation. To remain covert, the CP-140 must be able to identify the target on a single pass and track it from beyond aided (binocular) visual range, so as to appear to the vessel as a chance encounter. Following identification, the target location and a description of its activity will be reported to the proper authorities. The CP-140 will maintain covert surveillance of the vessel until PLE, relieved, or the suspect vessel makes land, at which point the CP-140 will monitor the landing site and report significant activity. The CP-140 will continue to monitor covertly the landing site and assist other assets (e.g. police) to find the landing site and the suspects. Any activity that appears to involve transporting the contraband and/or suspects away from the landing site will be recorded by the CP-140.

Environmental Patrols

The objective of an environmental patrol is to chart the edge of the permanent ice, to detect, chart and monitor drifting icebergs, and to warn vessels and fixed installations of approaching hazards such as icebergs. Environmental patrols normally take place off the east coast, or in the arctic, during daylight in the late spring and early summer. This is when drifting ice is most prevalent and poses the greatest threat. The position, extent and type of sea

[1] PLE is the time during which an aircraft can remain airborne and still retain a given safety margin of fuel.

ice will be logged and reported, and possibly recorded on EO. This task may involve carrying one or two AES observers and conducting operations from Forward Operating Locations (FOLs).

Sovereignty Patrol.

The CP-140 may be tasked to fly a predetermined flight path in order to display a national presence. The CP-140 will identify, record, and report COIs, such as human habitation, wildlife, and environmental damage. Visual, radar and EO imagery can provide a permanent record of the mission.

Overland ISR

The CP-140 will fly to a designated location, search a given area, locate, and identify a specific contact (e.g., industrial sites, caches, and infrastructure). The CP-140 will then record images of the target, and log and report any significant details or activity. More specifically, the CP-140 may be tasked to support overland ISR mission such as:

a. **Route surveillance.** The CP-140 will establish a flight pattern to observe a pre-defined route from a covert location. Pertinent activity will be recorded in order to assess its usage by enemy forces.

b. **Convoy escort.** To provide dedicated support to a moving convoy, the CP-140 will establish a position in front of the units. All contacts will be detected and classified with potential threats being relayed back to the convoy prior to their possible engagement.

c. **Pattern of life monitoring.** To facilitate an attack, the CP-140 will conduct a systematic monitoring of a given point of interest in order to determine patterns with respect to personnel and vehicle movements.

Over-The-Horizon-Targeting

Over-the-horizon-targeting (OTHT) is a wartime mission normally performed in support of a friendly ship or task force. The crew determines a relatively safe but effective observation position and transmits targeting information back to the firing units of the friendly surface force. Potential targets may be land-based or water-based with positional information being provided to LF or Naval units.

ASW Operations

The CP-140's sensors and avionics (Section 3.3.3) were designed for ASW operations conducted under both peace[2] and wartime conditions. In either case, the sensors onboard the CP-140 are used to detect, localize, identify, and track submarines (nuclear and diesel-electric) while remaining as covert as possible, especially from the submarine. Monitoring the disposition of potentially hostile submarines is critical since their stealthiness and ability to launch long-range weapons allow the submarine to change from a peacetime patrol to a wartime configuration with relative ease.

A typical wartime submarine ASW mission begins with a transit during which the crew prepares the sensors and determines the tactics for the mission. Upon arrival in the tasked area, the crew would conduct a search, and upon gaining contact, would localize the submarine. Once localized, the submarine would be tracked until the crew has refined the submarine's position, course, and speed sufficiently to conduct an attack. After the weapon has been released the crew continues tracking the submarine in preparation for a re-attack should it be required.

As opposed to conducting its own attack, the CP-140 crew may provide vectors for another unit to conduct an attack (e.g. Maritime Helicopter) on a contact that has been localized. On completion of the attack run, the crew conducts post-attack tracking and prepares to conduct a re-attack.

3.3.2 Crew Composition

The operational crew of the CP-140 consists of a minimum of ten personnel. The crew may be expanded depending upon training requirements or for augmentation during intense operations. Crew integrity is maintained as much as possible. Individuals may be transferred from crew to crew to accommodate upgrading or to facilitate attendance at courses such as staff school. The crew may be divided into two main groups, the flight deck crew and the tactical crew.

The Flight Deck Crew

The minimum flight deck crew consists of two pilots (at least one is qualified as aircraft commander) and a Flight Engineer. For long missions or night missions the flight deck crew may be augmented by one pilot or one flight engineer, or both. After Wings Training, or when transferring from another aircraft type or ground tour, the pilots receive training to CP-140 first officer level at the Operational Training Unit (OTU) and are upgraded further by the squadron through an OJT program. They hold a valid qualification 032. The

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[2] Although peacetime ASW could be just as accurately called 'anti-submarine surveillance' since weapons are not deployed.

flight engineer receives training to the ‘C’ category level on the OTU and is upgraded on squadron to a minimum ‘B’ category.

The Tactical Crew

The tactical crew consists of four Navigators, of which two are acoustic sensor operators, and three Airborne Electronic Sensor Operators (AESOps).

a. **Navigators.** As a minimum, all CP-140 navigators begin with a basic wings standard, (qualification code 031), and receive CP-140 training on the Maritime Operational Aircrew Training (MOAT) course. Navigators starting their first Maritime tour graduate with both Navigator-Communicator (NAVCOM) and Acoustic Sensor Operator (ASO-2) qualifications. Navigators beginning their second tour or more as maritime navigators are trained as Tactical Navigators (TACNAVs) on an abbreviated MOAT syllabus, or through a squadron OJT program.

   The TACNAV is an experienced CP-140 navigator who has held or still holds an ASO and/or NAVCOM qualification. When the squadron requires more TACNAVs than the MOAT can provide, selected first-tour navigators are upgraded through a squadron OJT program. The majority of navigators employed regularly as NAVCOMs are recent MOAT graduates on their first tour; however, most CP-140 navigators hold a NAVCOM qualification, so a wide range of experience may be found at this station.

b. **Acoustic Sensor Operators.** The acoustic sensors are operated by the other two navigators. They operate as a team, with one operator (ASO-1) normally more senior to the other (ASO-2) and with increased responsibility. The ASO-1, usually a first-tour navigator with at least one year of CP-140 experience, is responsible for the effective management of the acoustic system, and for the accuracy of the information and analysis passed to the rest of the crew. The ASO-2 is often the most junior navigator on the crew and has been trained to operate all the equipment at the station, but is only responsible for some of the basic tasks performed at the acoustic station. Navigator upgrading is done through OJT conducted by more experienced crewmates and squadron training and standards navigators. On each crew one of the navigators is designated as the crew lead navigator, usually either the TACNAV or the ASO-1.

c. **Non-Acoustic Sensor Operators.** The non-acoustic sensors are operated by AESOps that are selected from various military occupations. Eligible candidates must hold a minimum rank of MCpl and must be volunteers. The majority originate from the combat arms and navy, and receive their wings upon completing their first MOAT course. Unlike navigators, AESOps use a category system to designate operator ability. The highest is ‘A’ category and the lowest is ‘C’. At least one ‘A’ Cat AESOp is

assigned to each crew and is designated lead AESOp. Whereas a 'C' Cat AESOp has just completed the OTU and can operate the equipment but lacks the experience to optimize sensor employment. Two of the AESOps, ((Non-Acoustic Sensor Operator) NASO-1 and -2), operate the non-acoustic sensors in the tactical compartment, and one, (NASO-3), manages the search stores in the ASW compartment. NASO-1 and -2 share the operation of the radar, Magnetic Anomaly Detection (MAD), Electronic Support Measures (ESM), and Forward Looking InfraRed (FLIR). Both stations have equal access to all four sensors, and the TACNAV and NAVCOM have access to the FLIR and limited access to the radar, so it is left to the crew to divide the duties as priorities and abilities dictate. The AESOps use a rotation system when manning their stations and the designated NASO-1 refers to the station rather than the experience level of its operator.

3.3.3 CP-140 Vehicle Characteristics

The intent of describing the CP-140 is to provide an overview into the various systems resident in the CP-140 aircraft. To that end, high-level descriptions of the features pertaining to the airframe, armament, and the avionics systems are reserved for the following sections. The CP-140 is currently going through significant upgrades as part of the AIMP.

Airframe

The CP-140 Aurora is a Canadianized version of the U.S. Navy's turboprop-powered Lockheed P-3 "Orion" long-range land-based maritime patrol aircraft. To that end, the CP-140 possesses an enhanced ASW electronics suite that has more in common with that of the jet-engined S-3 "Viking" carrier-based ASW patrol aircraft also operated by the U.S. Navy. The aircraft has a range of approximately 5 000 nm, and a maximum speed of 405 Knots Indicated Air Speed (KIAS).

Flight Control System

The CP-140 ailerons, wing flaps, elevators and rudder control surfaces are based on conventional mechanical systems, using dual hydraulic boosters. Trim tabs are provided for the ailerons, elevators, and rudder surfaces. The wing flap is a high lift flowler type, and the flap system has safety features to detect and prevent a split flap condition. Flap settings are provided for takeoff, in flight manoeuvring, approach, and landing. The AFCS is capable of controlling the aircraft for automatic approach and departure.

Communications System

The communication suite is comprised of a series of discrete radios, data transmission and encryption devices. As an integrated suite, the communication system provides the ability to converse/pass data with air and ground agencies in either a secure or unsecure mode. The communication system includes, but not limited to, the following equipment and capabilities:

a. Voice communications through VHF AM, V/UHF, and HF radios;

b. Data transmission including via Covered Radio Teletype (CRATT) and Data Link; and

c. Internal communications among crewmembers through the ICS.

Navigation Systems

The CP-140 navigation systems is made up of various discrete navigation systems which are integrated to provide the operator at the NAVCOM station the flexibility to control various configurations for each discrete systems. The overall navigation system includes, but is not limited to, the following: IFF, INS, OMEGA system, Doppler system, sextant system, low frequency ADF, TACAN, and VOR/ILS. In addition, the CP-140 will be equipped with a FMS to support the navigation of the aircraft.

Sensor Systems

A fully integrated sensor suite is required for the CP-140 to fulfill its primary mandate of surface and subsurface surveillance and control. To that end, the integrated suite supports searching for, detecting, localizing, classifying, tracking and recording COIs and includes the following:

a. **EO System.** The AIMP is being upgraded with an EO system that possesses both visible and IR collector systems. The IR system is used to detect passively, infrared radiation from objects. In turn, the system converts the temperature and emissivity differences and displays the results on video monitors. Narrow and wide fields of view are possible. The results are recorded on video tape. The IR camera provides 360° coverage by swinging 200° to the left and right, from the aircraft centre line. The IR can be directed by manually steering, automatic sector scan, or automatic tracking of a predetermined geographical point.

b. **Radar.** The CP-140 radar is used to detect, localize, and track airborne and surface targets by transmitting high power RF pulses and processing the received echoes into range and bearing data for display. The various operating modes provide the capacity to detect small targets in high sea states, as well as locating severe weather systems. The radar covers an

area in front of the wings, and 30° on either side behind the wing, for a total of 240° of coverage. Sixty degrees on either side of the tail of the aircraft are not covered. The radar is operated on line by the NASOs, TACNAV, and NAVCOM. It is operated off line by the NASOs in one of the modes to support detection and classification of both maritime and land targets.

c. **Electronic Support Measures.** The ESM is used to detect and classify friendly and hostile radar emissions. The system allows the crew to search for specific frequency bands and analyze detection of radar emitters. It also provides the capability to identify the direction from which the signal is generated.

d. **Magnetic Anomaly Detection System.** The MAD system detects ferromagnetic objects by measuring magnetic anomalies in the earth's magnetic field. For a given location, at close range the system will be able to establish the presence of ferromagnetic objects, such as a submarine despite its effort to hide deep in the water. The General Purpose Digital Computer (GPDC) receives and displays these signals. The MAD is controlled on line and off line at the NASO station.

e. **Acoustics System.** The Acoustics System, which is the primary ASW sensor onboard the CP-140, is used to detect, classify and localize friendly and hostile subsurface and surface vessels based on their emission of sound energy into the water. The system relies primarily on information received from various types of expendable sonobuoys, both passive and active. The AIMP is capable of simultaneously receiving 99 VHF-FM sonobuoy RF channels, and of simultaneously monitoring 32 sonobuoys. This system is used in conjunction with the Sonobuoy Reference System (SRS), to compute and update the relative position and bearing of deployed sonobuoys with respect to the aircraft's navigation system. This updating is performed without requiring the aircraft to overfly the sonobuoys in question.

Armaments

The CP-140 armament system allows for the selection, arming, and releasing of weapons from the bomb bay and wing pylons. There are eight bomb bay weapon stations capable of carrying and releasing bombs or torpedos. There are ten stations on the wing pylons which can carry a maximum combined weight of 19,838 lbs. The weapons are a combination of bombs, (500 lb, 1000 lb, and 2,000 lb), torpedoes, mines, and rockets.

The weapons are selected by the TACNAV, but can be released by the TACNAV, NAVCOM, or pilot. The weapons can be selected and armed on line by the GPDC, or off line through manual armament selection.

3.4 AIMS System Description

This section is intended to provide a high-level overview of the proposed AIMS system in order to provide context to the subsequent analysis. Details of AIMS design have been reserved for the AIMS OMI Design Study.

NOTE: Since the creation of this report, the AIMS system configuration has changed—the colour camera WFOV has been substituted with a laser rangefinder. The following system description reflects the AIMS system configuration at the time of writing this report (i.e. no laser rangefinder). The OMI design concepts in subsequent sections of this report are also aligned with this original configuration.

3.4.1 AIMS Characteristics

In accordance with the AIMS Technology Demonstration Program (TDP) Requirements Specification [Reference 12], the AIMS system will provide the following operational characteristics:

a. Enhanced target discrimination and localization in surveillance and tactical environments using integrated active imaging, thermal sensing, mapping and optimized search algorithms.

b. State of the art automatic target detection and recognition, image processing and target tracking that reduce crew workload and stress, while improving target detection and recognition in SAR, surveillance and target designation missions.

c. Increased knowledge on metadata, data management and information dissemination requirements in a network-enabled environment such as C4ISR.

d. Integrated information display, optimized on human factors considerations.

e. Improved search methodologies through sensor modeling in a new mission planning tool.

3.4.2 AIMS Components

Figure 2 depicts the air and ground segments that comprise the AIMS system. The focus of the OMI effort articulated in this report is the controls and displays that comprise the Operator Station. The operation workstation provides the primary interface to the AIMS sensor package containing the imaging sensors which are used to search, detect, classify, identify, and track objects of interest. The AIMS system is based on a modified Wescam MX-20 turret and will be comprised of the following imaging sensors:

a. Infrared (IR) thermal imager (mid-wave IR);

b. Electro Optic (EO) Narrow Field of View (NFOV) (visible; near-IR);

c. Active Gated Television (AGTV) NFOV;

d. AGTV Wide Field of View (WFOV) [3]; and

e. Colour camera WFOV.

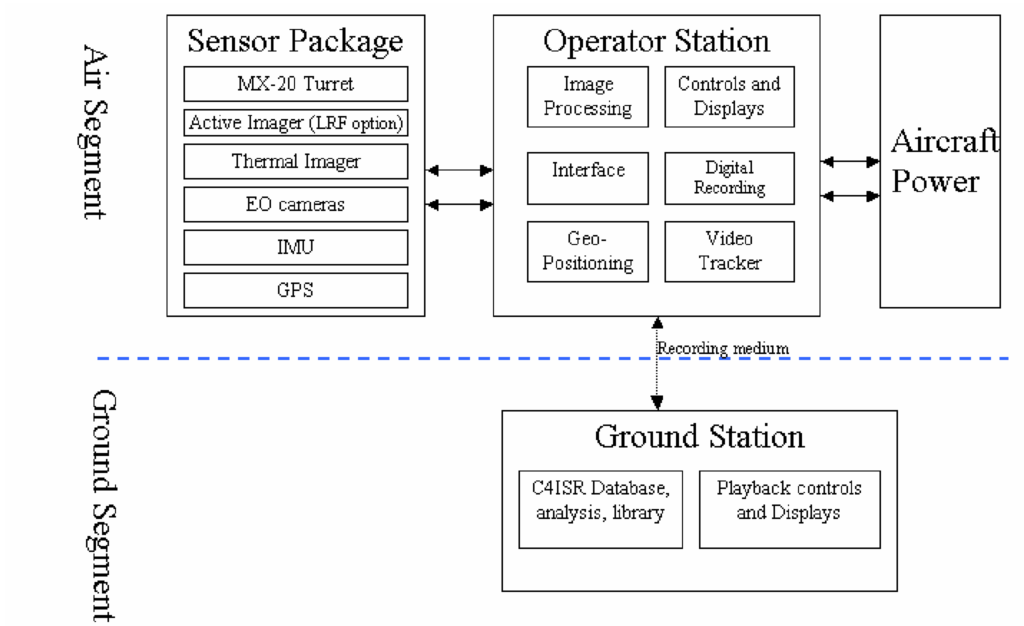

Figure 2. *AIMS System Integration*

3.4.3 Wescam MX-20 Sensor Turret

The AIMS sensors will be housed in the Wescam MX-20 sensor turret (Figure 3). The steering range is 360° continuous rotation for the azimuth and +90° to -120° for the elevation. The steering slew rates will vary from 0 to 57.3°/s. The modes of operation include rate, position, geo-pointing (sub mode of rate and geo), Autoscan, Step-Stare (Strip and Spot), Forward and Stow.

[3] As noted earlier, this imaging sensor has since been replaced with a laser rangefinder.

Figure 3. *Wescam MX-20 Sensor Turret*

3.5 Factors Affecting the Mission

3.5.1 General

Various factors affect the ability of any ship to conduct its mission. This subsection considers the factors common to virtually any operation, and their potential impact on mission accomplishment.

3.5.2 Day/Night Operations

Missions may take place during both the daytime and nighttime. For instance, distress incidents may be reported at any time of the day or night. Similarly, covert operations may be facilitated by flying during the night. For maximum effectiveness, the FWSAR and CP-140 aircrafts must be capable of responding to a tasking at any time of the day or night in conditions varying from bright sunlight to total darkness.

3.5.3 Geography

The geographical scope of operations is immense for both aircrafts. The area of responsibility for the FWSAR aircraft comprises the entire Canadian land mass and large oceanic areas as identified in ICAO and IMO international

governmental agreements. In addition to these domestic areas, the CP-140 may be deployed within international theatres of operation.

Terrain can have an impact on aviation. For instance, mountainous terrain will interact with the wind to cause downdrafts and updrafts. Mountains may also affect flight conditions by causing moist air to cool and condense into cloud and precipitation. The windward side of a mountain range will normally experience fewer clear days than the leeward side.

3.5.4 Meteorology

The FWSAR and CP-140 aircrafts will be expected to operate day or night in all weather conditions which are considered safe for flight. Canada experiences a wide diversity of climates with significant seasonal changes in most areas. The effects of weather may enhance an aircraft's performance or degrade it in all aspects ranging from the aircraft's overall mobility, the ability of personnel to perform, as well as sensor and weapon performance. Degradation of sensors by adverse weather conditions may severely impact the outcome of a mission by inhibiting the aircraft's ability to detect, classify, identify, or track a COI. Weather phenomena which may affect flight include:

a. **Cloud.** Clouds are a significant obstruction to aviation activities. Clouds may manifest themselves in many forms and are generally associated with other adverse weather phenomena such as icing, turbulence, reduced visibility and precipitation. Clouds may occur at any altitude from ground level to over 30,000 feet. Visual search can be rendered impossible in cloud. The restrictions to visibility caused by cloud may be overcome to a certain extent with the use of active-gated cameras to penetrate the cloud and provide images of the external environment to the crew.

b. **Fog.** Fog invokes many of the same types of problems as cloud. Fog is particularly abundant in Canadian coastal areas. Fog frequently follows seasonal trends and may also appear on a nightly basis in certain areas due to night time cooling and resulting saturation of the air mass. Fog may prevent flying activity entirely by reducing airport visibility below instrument approach minimums. Fog in a search area generally prevents visual search, although it may be possible to conduct visual flying activities above the fog layer.

c. **Precipitation.** Precipitation may occur in many forms. All precipitation reduces visibility to some extent and in extreme cases may reduce visibility to zero. Precipitation may therefore force an aircraft to fly at a lower altitude and speed in order to maintain visual contact with the ground, maintain sufficient forward visibility to see and avoid obstacles, and to permit effective visual search by spotters. Flying at a lower altitude reduces the track spacing for an effective search and combined with the slower speed, will significantly increase the time required to

perform visual search. These penalties may be overcome to a certain extent with the use of sensors to penetrate the precipitation and provide improved visibility to the crew. The ability to overcome restrictions to visibility is a major key to achieving an all-weather search and rescue capability.

d. **Turbulence.** Turbulence reduces the crew's ability to conduct visual spotting, and reduces their ability to read small characters on displays and controls. Turbulence levels determine the degree and frequency of stabilization inputs to sensors and flight controls. Turbulence also increases crew fatigue and in some cases, incapacitates crewmembers.

e. **Temperature.** Temperature affects aircraft flight performance and sensor performance and temperature extremes may restrict flight.

f. **Surface Winds.** Surface wind direction and speed influences search tactics, decreases or increases range, affects sea state and may cause low level turbulence.

g. **Winds Aloft.** Enroute wind direction and speed may decrease or increase range, and is a major determining factor in route planning.

h. **Humidity.** High humidity can adversely affect EO sensor performance by fogging lenses and receptors. High humidity can reduce visibility through the cumulative effect of atmospheric moisture over distance.

3.5.5 Time and Space Constraints

The mission may be conducted at great distances from the home bases of the tasked assets; therefore, the ability to have theses assets available where and when they are needed is heavily dependant on timely and accurate intelligence information. Extended transit times are a major factor to be considered in mission planning. Timely and accurate intelligence is also a major factor in determining the actual surveillance time required. Without high quality intelligence surveillance activities may have to be conducted for several days leading up to detecting the COI.

3.5.6 Psychological Aspects

There will be psychological aspects associated with the primary operator in the addition to the use of the AIMS system. These are primarily stress related and are associated with factors such as high workload, multi-tasking, time constraints and the consequence of error. The impact of each of these factors on operator stress levels and ultimately on human performance will vary throughout the fleet depending on the tempo, type of operation and experience level of the operator.

Mental fatigue and other stress-related factors can impact operator performance in areas such as cognitive processing and decision-making, potentially resulting in increased error rates (poor decisions) or delays in making decisions. Fatigue can further impact human performance in critical mission functions, such as the prosecution of tracks and targets over prolonged periods of time.

3.5.7 Interoperability with Other Friendly Forces

The aim of interoperability when multinational forces and assets unite is to achieve maximum mission effectiveness with the minimum expenditure of resources. To achieve this aim, aircraft and other units must understand each other's capabilities, limitations, and procedures when conducting joint operations. For example, outside of independent operations Canadian ships may operate with the CP-140 when conducting sovereignty or ASW patrols. The CP-140 may also collaborate with the LF to conduct overland ISR missions.

3.6 Mission Scenarios

The mission analysis included the development of a series of mission scenarios consisting of critical and high workload mission segments. Each scenario represents a realistic situation.

For the AIMS analysis, the knowledge and experience of the CP-140 SMEs was leveraged by having them participate directly in the development of the scenarios. CAE PS analysts also utilized experience from previous HFE analysis projects [References 16, 17, 18] to ensure that mission segments which are likely to be critical to the design of the AIMS OMI are incorporated. Each scenario is documented as a narrative description of the chronological sequence of events.

3.6.1 FWSAR Scenarios

For the FWSAR aircraft, eight typical individual sorties as well as a composite mission scenario are captured in Annex D of the FWSAR SOI [Reference 5]. The eight sorties are:

a. SAR 1 – Overland and Arctic

b. SAR 2 – Mountainous Terrain

c. SAR 3 – Maritime Distress

d. SAR 4 – Aeromedical Evacuation

e. Transport/Utility/Ferry

f. SAR/Crew Training

g. Pilot Training

h. Maintenance Test Flight

The composite mission scenario represents an amalgamation of the most demanding situations from the individual sorties. To that end, it is comprised of mission segments from the first three SAR sorties (Overland and Arctic, Mountainous Terrain, and Maritime Distress).

3.6.2 CP-140 Scenarios

Four separate mission scenarios were developed to analyse the anticipated use of the AIMS system within the CP-140 aircraft. The following scenarios have been captured in Annex A:

a. SAR – Overland and Arctic;

b. Fisheries Patrol; and

c. Overland Surveillance of Targets and OTHT.

4. Function Analysis

4.1 General

The objective of the Function Analysis is to identify the functions and sequences of functions that must be performed by the individual aircrafts to achieve mission objectives. In accordance with HFE processes described in MIL-HDBK-46855A, this consists of a top-down analysis of the missions developed during the Mission Analysis phase. The Function Analysis is based on a particular system, although the higher-level functions are largely independent of the system being analyzed. For this phase of the analysis, the "system" is defined as the FWSAR or CP-140 AIMP augmented with the AIMS system.

The Function Analysis established the basis for the subsequent Task Analysis. It resulted in two data product (Function Flow Diagrams and Task Inventory) which are described briefly in the subsequent subsections.

4.2 Top and First Level Functions

An analysis of all top and first level functions associated with the FWSAR and CP-140 AIMP missions is contained in the following subsections. Figure 4 depicts the top level functions for the FWSAR aircraft as documented in Reference 6. Similarly, Figure 5 illustrates the CP-140 aircraft top level functions. To maintain commonality with the FWSAR aircraft, a similar framework for the top-level FFDs was utilized for the CP-140. To that end, both sets of aircraft exhibit three common groupings of top-level functions:

a. **Preflight, Departure, and Transit** – correspond to those activities related to receiving a tasking, and subsequently taking the aircraft from Pre-Flight Inspection (PFI) to the level off at transit altitude;

b. **Missions** – captures the missions that may be conducted by each aircraft as defined in the mission analysis (Section 3); and

c. **Off Task, Transit and Arrive at Base** – encompasses those activities when the aircraft proceeds off task and continues until aircraft shut down has been completed at base.

At this level of the functional abstraction, the first (Preflight, Departure, and Transit) and third (Off Task, Transit and Arrive at Base) functional groupings are alike across the FWSAR and CP-140 aircrafts. However, given their distinct operational roles and missions, the two aircrafts deviate with respect to the second functional grouping

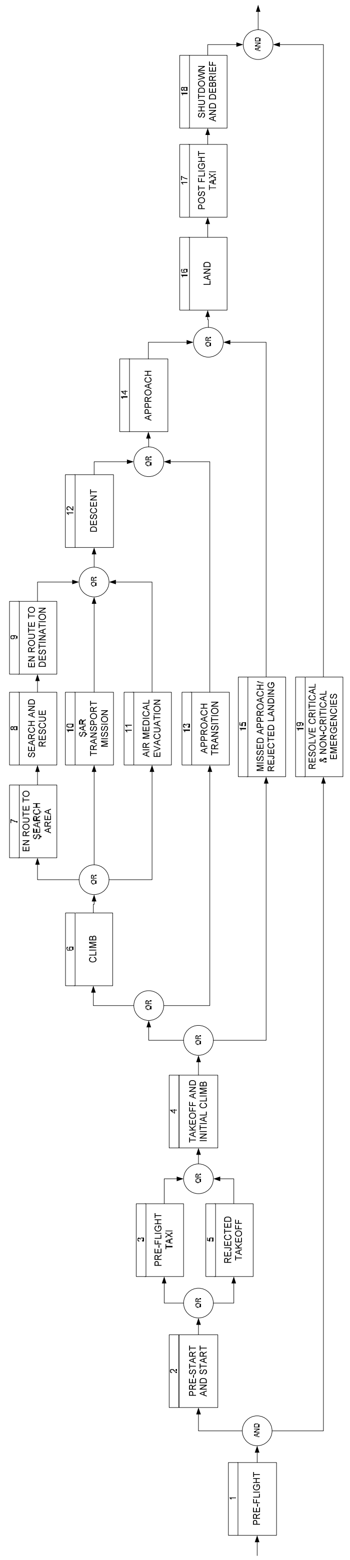

Figure 4. *FWSAR Top Level FFD*

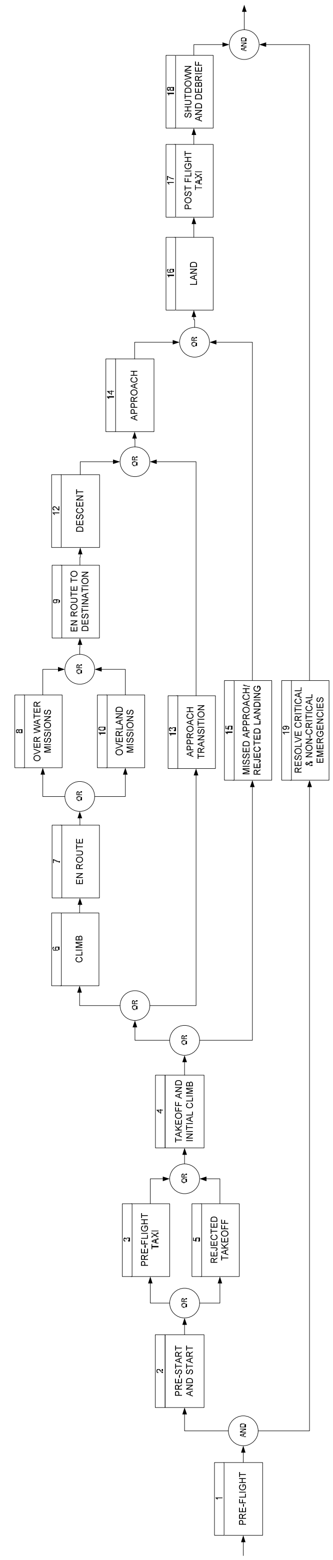

Figure 5. *CP-140 AIMP Top Level FFD*

(Missions)[4]. The following sections describe in detail the top and first level functions while focusing on the utilization of the EO/IR system (e.g. AIMS) to support the higher level mission objectives.

4.3 Preflight, Departure, and Transit

The "Preflight, Departure and Transit" functional grouping encompasses all the activities involved in receiving a tasking, taking the aircraft from Pre-Flight Inspection (PFI) to the level off at transit altitude. Although not considered a mission in itself, this function is common to all missions independent of subsequent tasking and therefore deemed worthy of representation as a separate grouping of functions. Interaction with the EO/IR system would be minimal; limited to conducting pre-flight serviceability checks, and configuring the sensor for the upcoming mission. Although not integral to the AIMS system, these top level functions are described in this document for completeness.

4.3.1 SECTION 1 – Pre-Flight

The "Pre-Flight" function encompasses the crew reporting for duty and receiving their tasking. Upon receiving the tasking and prior to proceeding to the aircraft, the crew will perform all necessary flight planning such as checking the weather, calculating fuel load, preparing a flight plan, and reviewing the load plan. Simultaneously, the FE proceeds to the aircraft for pre-flight preparations including external and internal inspections of the aircraft and equipment.

4.3.2 SECTION 2 – Pre-Start and Start

As part of the "Pre-Start and Start" function, the crewmembers board the aircraft after the mission briefing, and individually stow their personal equipment and the carry-on mission equipment. When stable electrical power is available, each crewmember performs a series of serviceability checks (in accordance with Aircraft Operation Instructions) to verify the correct operation of their respective mission and aircraft systems. Squadron maintenance personnel are summoned to rectify any detected malfunctions prior to start. If the fault cannot be corrected, the negative impact of the unserviceability is considered and the AC determines whether the mission may continue. The AC monitors the progress of the PFI to ensure that the scheduled takeoff time is met with the appropriate serviceable systems.

The copilot initiates the pre-start check after the PFI. The engines are started by the pilots. When electrical power is available, the Auxiliary Power Unit

[4] To compensate for the difference in the number of missions performed by each aircraft while maintaining a consistent numbering scheme for the first (Preflight, Departure, and Transit) and third (Off Task, Transit and Arrive at Base) functional groupings across the FWSAR and CP-140 aircrafts, the CP-140 FFD does not possess a top-level function numbered 11.

(APU) is shut down by the copilot, or the ground power unit is removed by the start crew. The crew confirms that their respective aircraft and mission systems are on-line and functionally checked.

4.3.3 SECTION 3 – Pre-Flight Taxi

The “Pre-flight Taxi” function commences with the crew conducting the pre-taxi check. The copilot obtains clearance to taxi and requests airways clearance if the flight is in accordance with Instrument Flight Rules (IFR). The pilot begins to taxi the aircraft to the takeoff or hold position on the airfield, as cleared by Air Traffic Control (ATC). During the taxi, the flight controls, navigation aids, and flight instruments are checked. High power emitters are checked for serviceability after the pilot advises that the aircraft is clear of all personnel, vehicles, and buildings. The airways clearance is normally given during taxi by ATC and read back by the copilot.

4.3.4 SECTION 4 – Takeoff and Initial Climb

The “Takeoff and Initial Climb” function commences upon obtaining takeoff clearance from ATC and the crew conducting the pre-takeoff check to ensure that the navigation aids, flight controls, and engines are configured for takeoff. The AC defines the normal and emergency procedures for takeoff. The copilot monitors the takeoff and calls out engine indications as required. During the takeoff roll, the pilot controls the aircraft, the FE manipulates the power levers at the pilot’s direction, and the copilot communicates with the tower and monitors the aircraft airspeed, calling out the critical speeds as they occur. When the aircraft is airborne, and the landing gear and flaps have been retracted, the aircraft is flown according to the airfield departure procedure. The power assurance checks are also conducted and correct functioning of the attitude indicator, altimeters and vertical speed indicators is verified. Once the aircraft is confirmed to be functioning normally, the departure procedure is initiated. The pilot flies the departure procedure, backed up by the copilot.

The radar is turned on and optimized for traffic and obstacle avoidance during departure. A cabin crewmember performs a visual inspection of the interior compartments for heat build-up or fire, and checks visible exterior features for evidence of icing, damage, and fire. As the aircraft nears the completion of the departure procedure, the copilot ensures that the first en route waypoint is selected for steering.

4.3.5 SECTION 5 – Rejected Takeoff

In the event that a significant problem is realized while positioning the aircraft on the runway, the crew may decide to reject the takeoff. ATC will be notified of the situation and circumstances for the decision to abort the takeoff. The aircraft will be taxied away from the runway and re-assessed to

determine any corrective actions that may be required to render the aircraft suitable for flying.

4.3.6 SECTION 6 – Climb

When the departure procedure is complete and the aircraft is climbing en route to the on station point, the navigation system accuracy is assessed, and the relevant publications are distributed. The aircraft climbs until it levels off at a suitable altitude for transiting to its area of responsibility. During the transit the crew continues to communicate with ATC.

4.3.7 SECTION 7 – En Route to Search Area

During the transit to the on-station point mission data are inserted and the sensors are prepared for the on station checks. About twenty minutes prior to reaching the on-station point the crew conducts the on-station check ensuring that the aircraft is configured for the mission profile.

4.4 Missions – FWSAR

4.4.1 General

Although the FWSAR aircraft may be tasked for several different roles, only the Search and Rescue mission was analysed since it sufficiently addresses the scope of anticipated interactions by the FWSAR crew with the AIMS system. The remaining FWSAR missions (SAR Transport Mission and Air Medical Evacuation) do not introduce significant added value with respect to AIMS-specific interactions.

4.4.2 SECTION 8 – Search and Rescue

The SAR mission encompasses all the activities involved in taking the FWSAR aircraft from preparing for a search through the search phase, the identification of the search object, conduct of the rescue, and the preparation for transit (Figure 6). This functional decomposition does not differentiate between maritime, aeronautical, or ground SAR missions.

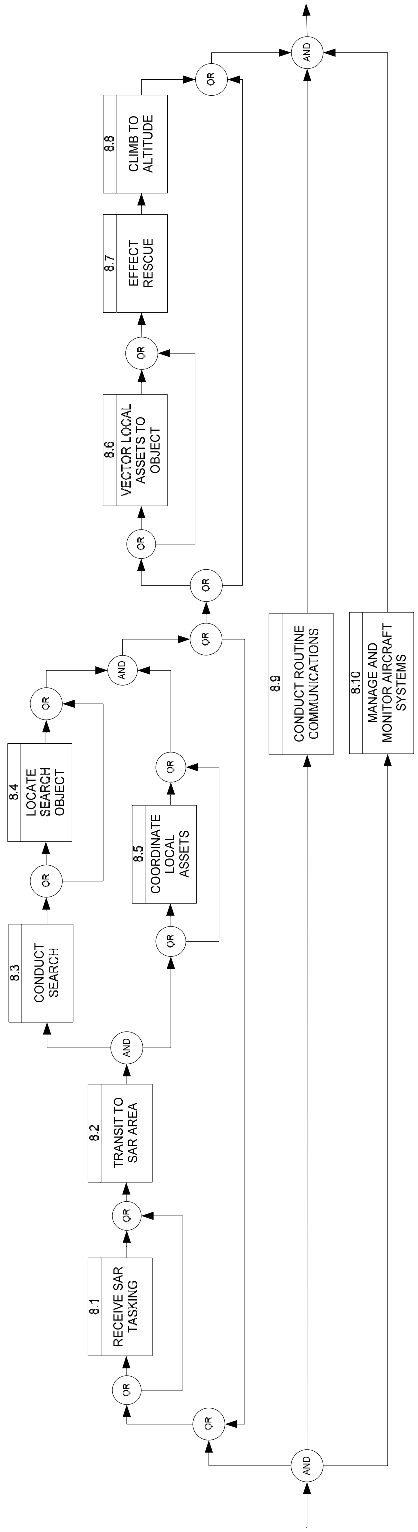

Figure 6. *FWSAR Search and Rescue*

Segment 8.1 – Receive SAR Tasking

If tasked on a SAR mission from base, the aircraft transits to the SAR area and conducts the operations. If the crew is airborne, JRCC will contact the crew in the air and task them with the operational mission. On receipt of a tasking, the crew will determine the feasibility of carrying it out. The crew will evaluate fuel, weather, distance, time of day, crew rest, equipment on board, aircraft serviceability, and time available before next inspection in determining whether the tasking can be accepted as is, whether it can be modified, or must be rejected. If the general location of the distress is known, the AC will turn the aircraft in that direction immediately and commence the transit, even though the decision to accept the mission has not been made. The only exception to this would be if the fuel state is such that the aircraft would be clearly unable to complete the mission, in which case the AC would proceed to the most convenient fuelling location. Once all aspects of the tasking have been evaluated, the crew will advise JRCC as to whether the mission is accepted, declined or requires modification prior to acceptance. The crew will also inform the JRCC of the estimated time of arrival (ETA) for the distress area, and whether or not they can proceed directly or must refuel, add equipment, or change the tasking in some other way. The crew maintains communications with the tasking authority during the SAR tasking, and reports the progress of the mission at regular intervals.

A fly-to-point (FTP) for the search area or last known position of the search object is entered into the FMS. The pilot follows the steering information presented on the instrumentation to turn toward the FTP and climbs to transit altitude. If the route takes the aircraft into controlled airspace, the copilot contacts ATC for clearance.

Segment 8.2 – Transit to SAR Area

As the aircraft is transiting to the search area, the crewmembers prepare and configure search sensors and equipment to maximize the probability of detection of the search object. In addition, the crew performs routine flying and navigation tasks as well as aircraft checks. Regular progress reports are delivered to the controlling agency and a watch is maintained for conflicting traffic, severe weather conditions, or high terrain. The crew tunes the radio receivers to the appropriate distress frequencies, and each crewmember selects all radios for monitoring. It is assumed that the crew has already determined the best approach to take for the pending search based on the search object and expected weather conditions. Any additional mission preparation will be conducted as required prior to arriving at the search area.

The crew establishes communications with the controlling agency, the responsible JRCC, and the local SM. Additional detailed information from JRCC about the search object, other assets available, and the circumstances that brought about the SAR situation are provided.

Segment 8.3 – Conduct Search

As the aircraft approaches the search area, the crew is alert for the sound of an ELT, PLB or other distress beacons. Depending on the situation, the pilot may fly across the search area at transit altitude to maximize the chances of detecting a distress beacon. The radar operator begins a radar surface plot of the area. The EO operator determines the detection range for the size and type of the search object and the observed weather conditions.

If an electronic distress signal is received or relayed from another source, the crew proceeds to the area and localizes the signal. If no electronic signal is received, the crew prepares to conduct a sensor search. The employment of sensors will have been determined during the en route search planning phase and takes into account the search object, the local assets available, the radar plot, and the local conditions. The aircraft descends to an appropriate radar/EO/visual search altitude and begins to fly a pre-determined search pattern. The copilot programs the FMS to provide a series of waypoints for the search pattern. The desired track spacing and line length are entered and the pilot follows the steering commands to each successive waypoint. The radar operator selects the appropriate radar parameters and adjusts the tilt control to achieve the maximum probability of detecting the search object. Similarly, the EO operator adjusts the system parameters including selecting an appropriate FOV for monitoring the display. The EO operator uses the EO system to scan the area, employing automatic scan features if feasible. The lookouts begin a systematic scan of their fields of view. Ideally, the search starts with relatively wide track spacing to cover the search area as quickly as possible. If nothing is found, the track spacing is decreased or the search area is expanded and additional search resources may be introduced.

The search continues until the object is sighted, or the area is covered. If the object is not found, the crew evaluates the progress of the search, and in consultation with JRCC and local assets, formulates and executes a new search plan. The FWSAR aircraft remains in the search mode until the object is found or PLE is reached.

Segment 8.4 – Locate Search Object

When the contact is detected by one of the sensors, the position is determined based on the range and bearing information available from the sensor. If an imaging sensor holds contact, the image is recorded. When the contact is detected by one of the lookouts, the distance and relative bearing to the contact are reported, and the lookout generally provides homing instructions to the pilot. The operator in contact vectors the pilot to the object, while efforts are made to acquire the contact with other sensors. In this manner, the position and nature of the contact are determined and stored. When the object of the search is detected it is generally treated in the same manner as all other contacts until the identification is made. Once the search object is identified, the other SAR assets and JRCC are informed and the object's position is

reported. During the process of locating the search object, numerous false contacts may be detected and require investigation.

Segment 8.5 – Coordinate Local Assets

As the FWSAR aircraft arrives in the search area, the copilot contacts any other SAR assets already on scene including ground search parties, pleasure craft, fishing vessels, merchant ships, and dedicated SAR vessels and aircraft. Depending on the other assets available, the FWSAR aircraft may assume OSC duties due to its crew availability and greater endurance to remain on station. Communications from JRCC normally indicate what assets are available on station. However, the copilot may transmit a brief solicitation for SAR assistance on guard frequencies. The local SAR assets are correlated with contacts on the radar display by their reported positions, or by IFF/SIF.

The OSC is responsible for managing the activities of the assets on scene and coordinating communications between them. In coordination with the local SAR assets and JRCC, the FWSAR crew formulates a search plan for all assets and assigns search areas or duties to each platform according to their individual capabilities. If the search is centered on a small datum, the radar operator provides an initial vector to the datum to each vessel. After the search commences, the FWSAR crew solicits and compiles Situation Reports (SITREPs) from the local assets and relays the search progress to the JRCC.

Segment 8.6 – Vector Local Assets to Search Object

When the object is located by the FWSAR aircraft, the crew relays reports to JRCC and coordinates the rescue effort. The pilot establishes a loiter profile that allows the EO operator and/or lookouts to maintain contact with the object. The radar operator identifies the nearest asset capable of performing a rescue and provides vectors to the object. The EO operator works closely with the radar operator to vector the rescue vessel or helicopter to the object.

If the object is located by another platform, the FWSAR aircraft proceeds to the reported location of the object. The EO operator, radar operator and/or lookouts search for the object or rescue vessel, and vector the pilot over it when it is located. The pilot establishes a loiter profile that allows the EO operator and/or lookouts to maintain contact with the object. If a rescue helicopter is available, the radar operator vectors it to the object or to the rescue vessel if the survivors have already been recovered. The EO operator monitors and records the rescue, and the copilot or AESOP reports the progress of the rescue to the JRCC, the other SAR assets, and the tasking authority. The FWSAR aircraft remains on the scene until PLE is reached or the rescue is complete.

Segment 8.7 – Effect Rescue

The pilot generally orbits the distress site while the crew establishes a rescue plan. The rescue plan may be incomplete until such time as a crewmember arrives at the rescue site and carries out a full evaluation of the number of injured and the extent of the injuries. This information is generally transmitted to the aircraft later in the mission by the SAR Tech(s) at the site using the Notice of Crash Location (NOCL) message format.

If the crew finds survivors in need of food, water, or first aid equipment, the aircraft can drop the necessary supplies and equipment. SAR Tech(s) direct the dropping of equipment and supplies by parachute from the aircraft. If warranted, SAR Tech(s) may be parachuted into the vicinity of the SAR unit to provide a further assessment of the distress site. Once on the ground, the SAR Techs investigate the distress location and will provide the necessary on-scene medical attention and rescue for aviators, mariners and others in distress. FWSAR will remain on station until the survivors can be picked up and subsequently transported to a suitable destination to receive any medical attention.

Segment 8.8 – Climb to Altitude

Upon completing the rescue or reaching PLE, the FSWAR aircraft will climb to and level off at a cruise altitude prior to transiting to another destination.

Segment 8.9 – Conduct Routine Communications[5]

Tasks addressed by this function include maintaining routine communications with the tasking authority and/or ATC; monitoring appropriate guard and tactical frequencies; monitoring ICS; monitoring and copying the relevant weather broadcast on a regular basis; and transmitting hourly position reports.

All of these communications tasks occur independently of mission-specific communication activities. In this report, additional mission-specific activities are documented in conjunction with the related mission activity.

Segment 8.10 – Manage and Monitor Aircraft Systems

This function includes numerous ongoing activities relating to monitoring and/or managing basic aircraft systems, such as the fuel system, the engines and the FMS. These activities occur at regular intervals and relate to the health of the air vehicle. These functions typically are of secondary

[5] The “Conduct Routine Communications” and “Monitor and Manage Aircraft Systems” functions are essentially identical for all top level functions and therefore their descriptions are not repeated for all subsequent top level functions.

importance during the mission and will be carried out when time is available after the primary mission functions are completed.

4.5 Missions – CP-140 AIMP

4.5.1 General

The CP-140 can be tasked for a series of potential missions as outlined in Section 4.2. For the purposes of this analysis, only a representative subset of these missions are analysed in greater detail to further illustrate the anticipated use of the AIMS system within these contexts to support detection, localization, classification, identification, and tracking of COIs.

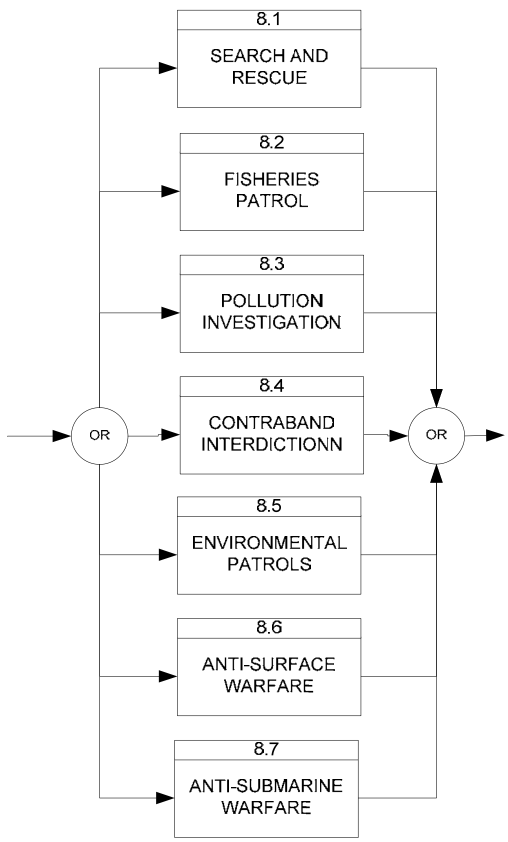

Figure 7. *CP-140 Over Water Missions*

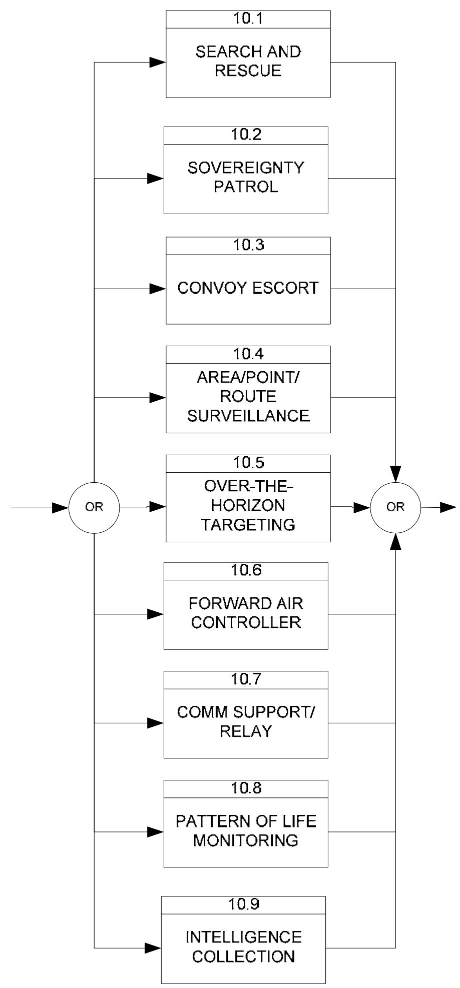

Figure 8. *CP-140 Overland Missions*

4.5.2 Segment 8.1 – Search and Rescue

The first level functions that comprise the execution of a SAR mission are virtually identical for both the FWSAR and CP-140 platforms. As such, Section 4.4.2 which provides the high-level functions and descriptions for the execution of a SAR mission by the FSWAR aircraft can be re-used for the CP-140 aircraft. Minor variances in the execution of a SAR mission by the CP-140 include:

a. CP-140 may self-initiate a SAR operation when in the process of conducting another routine mission. This would occur if the aircraft receives a SAR event trigger such as an electronic signals intelligence 'hit' or witnesses a ship in distress. With instances such as these, the aircraft would relay the situation back to the tasking authority for consultation. If both parties deem the SAR incident to be a higher priority, the CP-140 will deviate from its original mission to address the SAR incident.

b. When supporting a SAR incident, the JRCC will traditionally make a determination of the type of search to be conducted by the CP-140. To that end, the CP-140 will be tasked as either a coordinating asset (i.e. assume OSC duties and coordinate SAR assets in the vicinity) or a search asset to detect, locate, and identify the object of the search. Historically, the CP-140 has been typically tasked as a search asset.

c. To conduct a rescue, the CP-140 is reserved to dropping a Survival Kit, Air-Droppable (SKAD) since it does not possess the capability or crew (i.e. SAR Tech) to perform a personnel drop.

4.5.3 Segment 8.2 – Fisheries Patrol

During a fisheries patrol the CP-140 will investigate and identify all fishing vessels in its assigned area, both to assist the DFO to manage the fishery as well as to detect, document and report fishing violators. Figure 9 illustrates the FFD associated with the conduct of this type of mission.

Segment 8.2.1 – Compile Surface Plot and Descend

As the CP-140 arrives on station, the NAVCOM transmits the 'On Station' report and secure voice communications are established with supporting vessels in the area. The current location of the supporting vessels is obtained, along with a SITREP, and the CP-140 position and intentions are reported. The Other Government Department (OGD) vessels are also identified on the radar display based on the positions reported. The CP-140 may be tasked by an OGD vessel to proceed to a specific location to investigate a suspected violator, or may be designated to search a specific area within the original

search area. If the OGD vessels have no specific taskings for the CP-140, the crew prepares to descend and classify the contacts in the area.

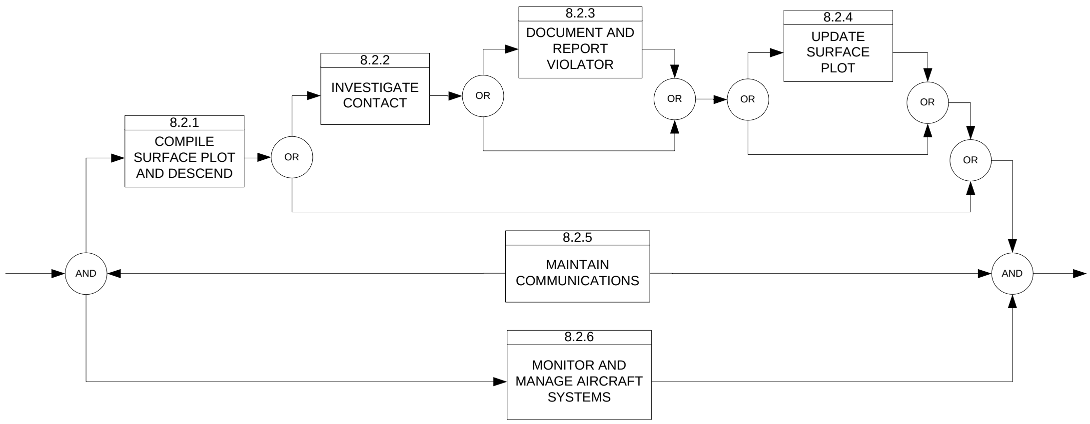

Figure 9. *CP-140 Fisheries Patrol*

The radar operator classifies the contacts in the area using the radar imaging mode. If multiple contacts exist in the assigned search area, the radar operator prioritizes the contacts for classification. The priority is driven by the mission objectives and takes into consideration factors such as the mean line of advance (MLA), apparent activity, proximity to natural features and fishing area boundaries, and relationship to adjacent contacts. If there are relatively few contacts in the area, the operator classifies each one. In either case, the contacts are classified one at a time as they are detected. In certain circumstances, the EO sensors may be used to corroborate the radar classification, or to make a more specific contact classification. As each contact is classified, the operator annotates the contact file with the vessel type.

When all the contacts in the area have been located, classified, and prioritized, the crew determines the descent point based on the disposition of contacts in the area, as shown by the radar plot. Other primary considerations are the predicted and observed weather conditions, particularly visibility and sea state. The radar operator begins reporting vectors for the first contact. The crew conducts a descent check to verify that the aircraft and mission systems are configured for the descent and that all crew members are alert and at their stations. The pilot descends the CP-140 while the radar operator checks the radar display.

Segment 8.2.2 – Investigate Contact

During the approach to the target, the copilot, EO operator, and visual lookouts attempt to ascertain the type of vessel and whether it is engaged in fishing. The pilot may complete the homing visually in daylight conditions with good visibility. When the CP-140 is positioned within an appropriate distance, the EO operator slews the EO turret to view the radar contact. The operator selects the appropriate camera depending on the conditions, and adjusts the settings to view pertinent details such as fishing lines or the vessel name. The EO operator reports that the contact has been detected and may assume control of the homing at the pilot's discretion.

During the approach the crew attempts to identify the vessel type, license number, and whether it is engaged in fishing or not. As the CP-140 flies past the contact, the EO operator slews the EO turret and adjusts the FOV in an attempt to read and record the vessel name and license. When the EO operator has located the name or license on the display, the image is captured for future reference. In daylight conditions, the lookouts may also attempt to read the vessel's name and license. As each item of information is obtained, the AESOP enters the name, license number, nationality, and observed fishing activity into the contact file. The EO operator begins recording images as soon as details of the contact are discernable.

After the vessel has been identified, the AESOP verifies the validity of the fishing license with an on-line database. The AESOP determines if the vessel is a violator based on the location of the vessel, the validity of the fishing license, and the observed fishing activity including equipment being employed. After the identification pass, the radar operator provides vectors to the next contact and the pilot begins turning toward it.

Segment 8.2.3 – Document and Report Violator

If a vessel is suspected of fishing illegally, the aircraft conducts a confirmation run. The EO operator ensures that the recording media is ready in order to bring the case to court and obtain a conviction. The confirmation run proceeds in exactly the same manner as the initial investigation, except that the crew's efforts are directed at obtaining recorded visual evidence of fishing activity or evasive manoeuvres, along with a clear image of the vessel identity and license.

During the confirmation run, the DFO officer may communicate with the violator. In this event, the AESOP records all communications. The violator is reported to a supporting vessel in the vicinity. The CP-140 may be required to vector a supporting OGD vessel to intercept the violator. The violation report is compiled and sent by the AESOP. The report includes the name of the vessel, the type of vessel, the fishing license number, the position, the MLA and a brief description of the fishing activity observed.

Segment 8.2.4 – Update Surface Plot

Upon completing the investigation of all the contacts in a given area, the radar operator directs the pilot towards the next known contact or group of contacts based on the radar surface plot. The pilot climbs to a transit altitude suitable for the distance to the next contact or group of contacts, and turns to the required heading. As the aircraft climbs and then levels off, the radar operator begins detecting and entering contacts. The operator begins to classify the contacts using the radar imaging modes, if necessary. The EO operator may assist in classifying contacts if the atmospheric conditions are conducive. Since long-range communications are less reliable at low altitudes, the crew may take the opportunity to transmit a position report or SITREP while at a higher altitude.

The crew re-evaluates the local weather conditions, and makes the necessary modifications to sensor configurations before descending to investigation altitude. When the classification of the next set of contacts is complete, the MC and radar operator determine the priority for contact investigation. During the descent to investigation altitude the radar operator monitors the radar for weather and obstructions while vectoring the pilot toward the contact. The crew conducts the investigation as described previously.

4.5.4 Segment 8.3 – Pollution Investigation

The conduct of a CP-140 pollution investigation, as illustrated in Figure 10, follows a similar sequence as the FISHPAT presented in the previous section.

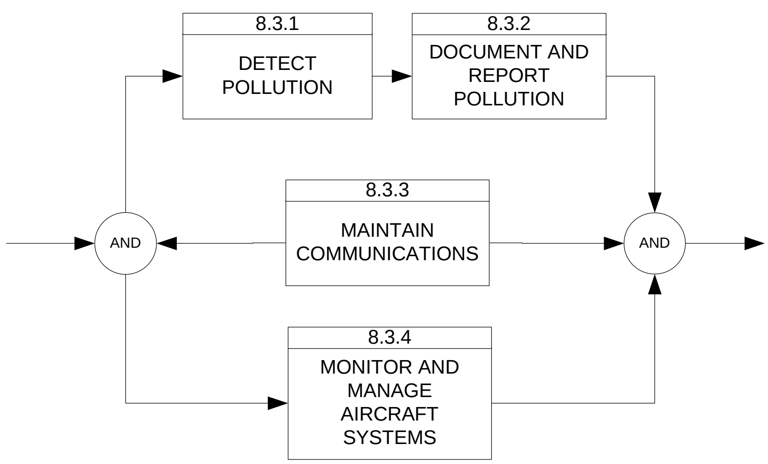

Figure 10. *CP-140 Pollution Investigation*

Segment 8.3.1 – Detect Pollution

Pollution investigation normally occurs as a result of a chance detection of pollution while performing another mission. Most often the pollution is detected when a crewmember notices a slick or solid waste during an identification run. During daylight, either pollution type may be detected visually and/or by IR, depending on the sea state, lighting conditions, and amount of pollution present. During night-time, liquid pollution can be detected using the IR sensor.

Segment 8.3.2 – Document and Report Pollution

As soon as pollution is detected, the crew starts a contact file with the date, time, and position of the observation. The on-top function may be used to mark the position of solid waste or the endpoints of a slick. The contact file continues to be compiled as information becomes available, including the name of the polluting vessel, its position, and MLA, as well as the extent and the type of pollution. If solid waste is detected, the crew documents the extent of it and reports it to shore authorities and/or an OGD vessel in the vicinity. Unless the crew is able to observe and record a vessel dumping the solid waste overboard it is difficult to determine its source.

When an oil slick has been detected, the crew attempts to discover the longitudinal axis of the slick through visual and IR observation. If the CP-140 is returning to a previously marked on-top position, the crew attempts to reacquire the pollution using visual and IR means. Once it has been acquired, the pilot follows it, either visually or under the direction of the EO operator. EO recordings of the slick are made for evidence and cleanup planning. If the source of the pollution has not been identified, the crew attempts to determine its source before determining the extent of the pollution. During this phase of the investigation, the radar operator attempts to correlate the slick with vessels in the area, based on the orientation of the slick, and the positions and MLAs of the vessels.

If the polluting vessel can be located and identified, it is recorded by the EO sensor. The images must show the name of the vessel, the pollution extending behind the vessel, and clear water ahead of the vessel. If possible, the images should also show the effluent leaving the vessel. If the source vessel cannot be located, the CP-140 crew records the extent of the pollution and reports it to shore authorities and/or an OGD vessel in the area. The CP-140 may be required to vector an OGD vessel to the pollution.

The CP-140 could be specifically tasked to investigate and monitor a known pollution incident, such as a ship breaking up or an oil platform accident. This task is similar to the chance encounter investigation described above. The position of the contact is usually known to within a small area thereby simplifying the search. Otherwise, the search is conducted in a similar manner to a general surveillance or fisheries patrol. The crew performs a

radar plot of the search area and then a descent to classification altitude. The radar operator classifies the radar contacts in the area using the imaging modes, and the EO operator may assist in classifying contacts.

The crew determines the priority of contact investigation based on knowledge of the contact of interest, and the disposition of contacts in the area. The pilot descends to investigation altitude and homes to the first contact under the direction of the radar operator. The crew continues to investigate contacts in this manner until the contact of interest is located. At that point the crew attempts to determine the extent of the pollution, and documents and reports it as described above.

4.5.5 Segment 8.4 – Contraband Interdiction

The CP-140 will be tasked to conduct an air-to-air intercept of an aircraft suspected of smuggling, or to perform surveillance of a vessel suspected of smuggling. Alternatively, the CP-140 may encounter suspect vessels while on an unrelated mission. A vessel involved in smuggling may be identified by its actions, its appearance, and/or by a match of its registry to an entry in a COI database. In all cases involving contraband interdiction, the CP-140 is operated so as not to reveal unusual interest in the suspect vessel or aircraft.

Segment 8.4.1 – Receive Tasking to Intercept Aircraft

An aircraft interdiction is initiated by NORAD operations through the tasking authority. The CP-140 may be tasked while airborne on another mission, or the standby crew may be launched to perform the intercept. If the tasking is received while airborne, the crew determines whether the tasking is feasible based on the serviceability of the aircraft and mission systems, the fuel remaining, the distance to the estimated Intercept Point (IP), and the distance from the current position to a suitable IP destination and alternate airfield. If it is considered feasible, the AESOp advises the tasking authority of the ETA to the IP and the estimated endurance available for shadowing. The pilot turns toward the IP and climbs to transit altitude. The tasking authority relays details of the target aircraft including its type, appearance, registration, altitude, speed, heading, and suspected destination.

Segment 8.4.2 – Transit on Vectors

The copilot establishes voice communications with the intercept controller (e.g. Airborne Warning and Control System (AWACS) aircraft). The pilot follows vectors to the IP, and levels off at transit altitude. During the transit, crewmembers prepare the mission equipment, configure the sensors, and ensure sufficient recording media is loaded. The radar operator assists the pilot in making the intercept by locating and tracking air contacts in the vicinity of the IP.

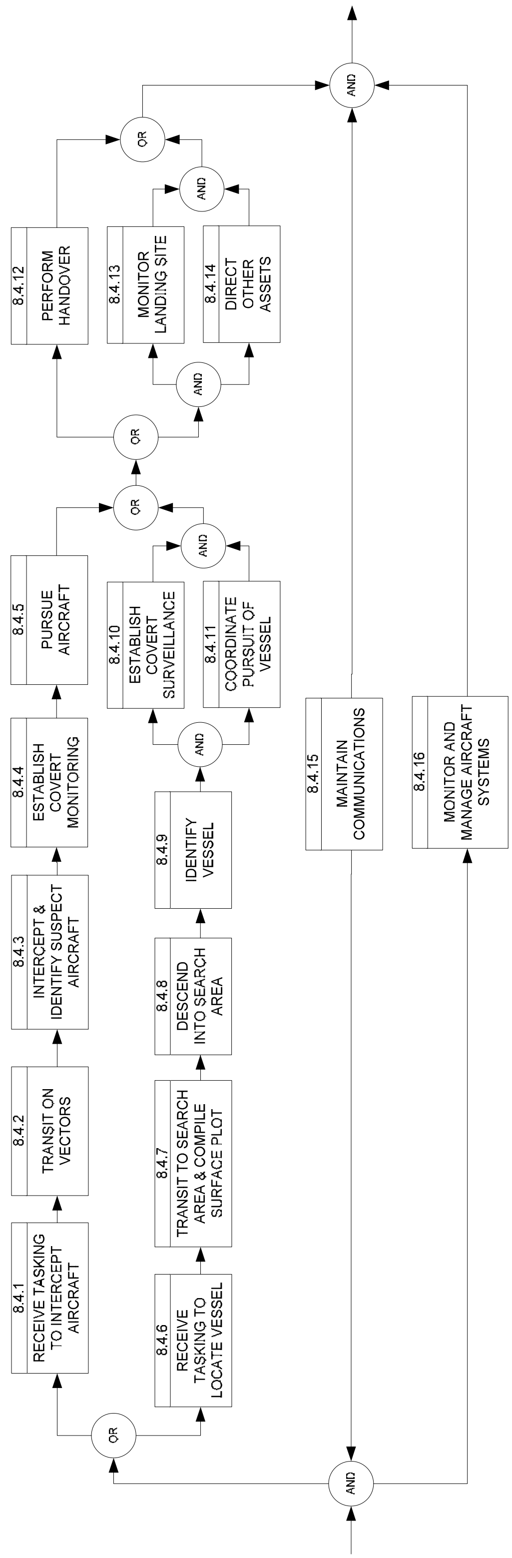

Figure 11. *CP-140 Contraband Interdiction*

The radar operator monitors the vectors reported and correlates them with the suspect aircraft on the radar display. In some cases the suspect aircraft may be identified using IFF interrogation. If the visibility allows, the EO operator begins to search for the suspect aircraft when the CP-140 closes to within a predefined distance. For the initial search, the EO is normally slewed to a radar contact.

Segment 8.4.3 – Intercept and Identify Suspect Aircraft

The CP-140 closes to within EO range of the suspect aircraft, but remains undetected by it. The pilot manoeuvres into a position from which the EO operator can identify the aircraft and record its markings. Aircraft markings may be intentionally obscured; therefore, two or more different approaches may have to be made before the aircraft is identified. The CP-140 does not normally approach the suspect aircraft close enough for an unaided visual identification because of the increased risk of counter-detection. The EO operator enters the target type, registration, markings, altitude, course, speed, position, time and SIF code into the contact file at the time of identification.

Segment 8.4.4 – Establish Covert Air-to-Air Monitoring

After the suspect aircraft has been identified, the pilot establishes a covert stern chase—typically behind, above, and slightly to one side of the contact. This minimizes the potential for counter-detection and allows the EO operator to maintain contact, which is especially important during night operations. The pilot normally positions the CP-140 so that the rear cargo door or boarding entrance of the suspect aircraft may be monitored since contraband may be delivered from the air via the cargo door, or smugglers may attempt to dispose of evidence during a pursuit.

Segment 8.4.5 – Pursue Aircraft

While the CP-140 maintains a covert stern chase of the suspect aircraft, continuous contact is maintained through radar, IFF/SIF interrogator, EO or visual means depending on the visibility and the behaviour of the contact. If the mission occurs at night, the AESOPs assist the pilot to maintain formation using radar and/or EO. The EO operator monitors the aircraft and continuously records and reports any significant activity, and logs the time and position at which it occurs. Activity such as aircraft manoeuvres, heading changes, and items being dropped from the suspect aircraft are reported to the controlling authority and supporting assets.

The CP-140 may be directed by the controlling authority to communicate with the suspect aircraft and direct a landing. If the aircraft complies, the CP-140 crew monitors the approach and landing. However, the suspect aircraft

may attempt to evade pursuit or otherwise refuse to follow the landing instructions from the CP-140, or the CP-140 may be directed to maintain covert surveillance until the suspect aircraft lands. In those cases, the CP-140 pursues the aircraft as covertly as possible until PLE is reached, or until relieved, or until the suspect aircraft lands. The activities associated with monitoring the landing site or conducting a handover are described in later sections.

Segment 8.4.6 – Receive Tasking to Locate Vessel

The CP-140 will be required to locate and identify vessels suspected of smuggling, and to shadow them covertly. The CP-140 may be diverted to this task from another mission already in progress. Alternatively, the mission may be the culmination of a lengthy police investigation and the CP-140 may be dispatched from base after a detailed briefing and extensive planning and preparation. RCMP officer(s) may be assigned to accompany the crew on a contraband interdiction mission. The policing authority recommends a search area based on intelligence gathered through an investigation.

If the tasking is received while airborne, the AESOP acknowledges receipt of the message. The tasking feasibility is determined based on the serviceability of the aircraft and mission systems, the fuel remaining, the distance to the search area, and the distance from the search area to a suitable destination and alternate airfield. If considered feasible, the AESOP advises the tasking authority of the ETA to the search area and the estimated time on station. The pilot turns toward the search area and climbs to transit altitude. The tasking authority relays details of the target vessel, including name, type, size, appearance, and suspected destination.

Segment 8.4.7 – Transit to Search Area and Compile Surface Plot

During the transit, the AESOPs prepare the sensors for the mission and the expected conditions, and ensure that sufficient recording media is loaded. The copilot performs the navigation functions. As the CP-140 approaches the assigned search area, the radar operator begins detecting and entering radar contacts. If the conditions allow it, the radar operator attempts to classify the closest contacts according to their size using the imaging mode. As the CP-140 comes within communications range of the search area, the crew establishes voice communications with the supporting vessels in the area. The current locations of the vessels are obtained and the CP-140 position and ETA are reported to the OGD vessels. The OGD vessels provide a SITREP to the CP-140 crew. The radar contacts representing the OGD vessels are annotated on the surface plot by the AESOP, based on the positions reported.

When the CP-140 arrives at the search area the AESOP informs the tasking authority and logs the transmission. An OGD vessel may direct the CP-140 to the COI, or may designate a specific search area for the CP-140. In any

case, the CP-140 crew normally begins the on station phase of the mission by compiling a radar surface plot of the area.

Segment 8.4.8 – Descend into Search Area

The AESOPs observe the local weather conditions using EO, radar and visual means, and gauge their effect on sensor performance. The MC and the L/AESOP determine the descent point based on the disposition of contacts in the area, and the predicted and observed weather conditions, particularly visibility and sea state. If required, the crew contacts ATC prior to descending within the search area. The crew conducts a descent check and then the pilot descends to the recommended altitude. The radar operator monitors the radar display for obstructions and heavy weather cells during the descent.

When the aircraft has reached a suitable altitude and the flight path is verified clear of obstructions, the radar operator switches to classification imaging mode. If there are a large number of contacts in the search area, the radar operator prioritizes the contacts for classification according to their MLA and position and according to the mission objectives. The contacts are classified one at a time, although a second operator may assist by classifying contacts or corroborating the radar classification using EO. As each contact is classified, the operator annotates the contact file with the vessel type.

Higher priority of investigation is given to those contacts which appear to conform to the description of the suspect vessel, by their size, vessel type, location, and/or activity. If two or more vessels are observed to be transmitting together or loitering in company, they are assigned a high priority. If other contacts are located en route to a high-priority contact, the CP-140 may investigate them. This may aid in promoting the deception that the CP-140 is simply performing a routine patrol, and not searching specifically for a certain contact. It is a particularly important consideration if other vessels are within visual range of the suspect vessel.

When the classification of contacts is complete and a list of potential suspect vessels has been compiled, the L/AESOP recommends a suitable altitude for investigating the contacts. The radar operator begins reporting vectors for the first contact and the pilot determines an appropriate descent point. During the descent and homing the radar operator monitors the radar display for weather cells, obstructions and other aircraft.

Segment 8.4.9 – Identify Vessel

The vessel of interest is located with radar or EO system. Identification is accomplished through EO observation. The CP-140 must be capable of identifying the target on a single pass, and tracking it from beyond aided

(binocular) visual range, so as to appear to the vessel as a chance encounter and remain covert.

During the homing to the contact, the EO operator uses the radar to slew the EO sensors to the contact. The operator selects an appropriate camera depending on the conditions, and adjusts the FOV, brightness and contrast as required. During the investigation, the EO images are recorded continuously as well as ICS and radio communications, which may be used as evidence. The EO operator reports that the contact has been detected and may take over the homing at the pilot's discretion. The EO operator may report observations to the crew on main ICS.

During the approach to each contact, the copilot, EO operator and visual lookouts attempt to ascertain the type of vessel and compare its appearance to the description of the suspect vessel. The pilot may complete the homing visually in daylight conditions with good visibility. When the CP-140 is sufficiently close to the contact, the EO operator may adjust the FOV to show pertinent details such as deck activity or the name of the vessel. The crew attempts to identify the vessel type and whether there is any suspicious activity on the deck or vessels alongside.

As the CP-140 flies past the contact, the EO operator slews the EO turret and adjusts the FOV to read and record the vessel name and port of registry. When the EO operator has located the name, or suspicious deck activity on the display, the operator presses a function key to place an index mark on the recording. As each item of information is obtained, the AESOP enters the name, license number, nationality and observed activity into the contact file using the CP-140WS keyboard. When the CP-140 is abeam the contact, the pilot, copilot or lookout presses an on-top switch to mark the contact position. In daylight conditions, the copilot also attempts to read the name and port of registry.

If it is not the suspect vessel, the radar operator provides vectors to the next contact, and the pilot begins navigating towards it. Upon identifying the suspect vessel, the MC usually orders a homing to the next contact so as to appear as though the CP-140 is conducting a routine patrol. It is important that the CP-140 overflies each contact only once.

Segment 8.4.10 – Establish Covert Monitoring

Following identification of the suspect vessel, the CP-140 is flown outside of binocular-aided visual range of the vessel before manoeuvring into a covert observation position. The optimum altitude, range and direction from which to monitor the vessel are established depending on the atmospheric conditions and the illumination available. Ideally, the vessel is monitored using EO, but if the weather conditions are unsuitable, it is tracked on radar. While the pilot is establishing the CP-140 in a covert observation profile, the copilot or

AESOP reports the location of the suspect vessel and a description of its activity to shore authorities and local OGD assets.

Segment 8.4.11 – Coordinate Pursuit of Vessel

The pilot maintains the CP-140 in a covert surveillance profile until PLE or relieved. The CP-140 crew transmits regular SITREPs to shore authorities and local OGD assets. The EO operator tracks the contact and records it continuously if conditions permit. The radar operator may be directed to vector OGD vessels into covert monitoring positions around the suspect vessel. The operator identifies the relevant contacts, and determines a suitable range from the contact for remaining covert, and then vectors them into position. The CP-140 crew reports any unusual activity to OGD assets, such as a manoeuvre or a rendezvous with another vessel. If one or more of the suspect vessels appears to be attempting to reach land, the CP-140 crew reports the event and monitors and records the landing covertly.

Segment 8.4.12 – Perform Handover

In the case that covert surveillance is required beyond the normal endurance of the CP-140; the CP-140 may be relieved by another CP-140, a Maritime Patrol Aircraft (MPA), a FG asset, or a surface vessel. Surface vessels are only employed in operations against other surface vessels, but aircraft may be employed in both air-to-surface and air-to-air operations.

The AESOP receives and receipts a message informing the CP-140 crew that a relief is en route, including its ETA. The crew prepares for the handover by ensuring that all relevant contacts are identified and tracked. The copilot and AESOP monitor the handover frequency. When the CP-140 crew is contacted by the relief aircraft or vessel the radar operator identifies it and vectors it into a covert observation position.

If the relief is taking over an air-to-air pursuit, the radar operator will assist it to approach, acquire the target, and join formation while maintaining aircraft separation. During this time the crew reports the local atmospheric conditions to the relief, and the observed sensor ranges if the relief is another CP-140. The locations of the OGD assets and the suspect vessels or aircraft are transferred by secure voice. The CP-140 does not depart until the relief has identified and begun tracking the suspect vessel or aircraft. After the relief begins recording sensor data, the EO operator stops recording, and the pilot breaks formation, or turns toward the off station point and initiates a climb to transit altitude.

Segment 8.4.13 – Monitor Landing Site

After the suspect aircraft or vessel lands, the pilot loiters over the airfield or landing site in such a way that the EO operator is able to continuously

observe and record significant activity. The landing site is monitored covertly until PLE, or until relief arrives. The EO operator notes and records vehicle traffic around the landing site as well as any suspicious activity that appears to involve transporting contraband and/or suspects.

Segment 8.4.14 – Direct Other Assets

The radar operator may be required to assist other assets to locate the landing site and the suspects. Other assets could include police on the ground, helicopter-borne tactical police or soldiers, or OGD vessels or small boats. After landing, the suspects may well have dispersed on foot or in vehicles, and the radar operator has to work closely with the EO operator to provide appropriate direction to OGD assets. The tasking authority may direct the CP-140 to maintain covert surveillance on a vehicle or vessel that appears to have left the landing area with the contraband and/or suspects. In that case the CP-140 continues covert surveillance, and directs the OGD assets in pursuit. The task continues until PLE is reached, or the CP-140 is relieved, or until all suspects are taken into custody and/or the contraband is recovered.

4.5.6 Segment 10.3 – Convoy Escort

The CP-140 may be tasked to conduct various types of overland surveillance in support of land forces. The exact nature and execution of these types of missions had not been fully defined during the conduct of the analysis. To that end, the following FFD with description represents a potential mission that could be undertaken by a CP-140 in support of LF operations based on the aircraft's capabilities.

Segment 10.3.1 – Fly Patrol Route and Compile Radar Plot

After transiting to the beginning of the patrol route, the pilot descends to the optimum radar search and classification altitude. As the CP-140 proceeds along the route, the radar operator compiles a radar plot of the area of responsibility. The copilot manages the FMS to ensure that the assigned route is followed, and monitors fuel and time remaining on station. The FMS is normally configured before takeoff, so little is required in the way of entering or selecting waypoints.

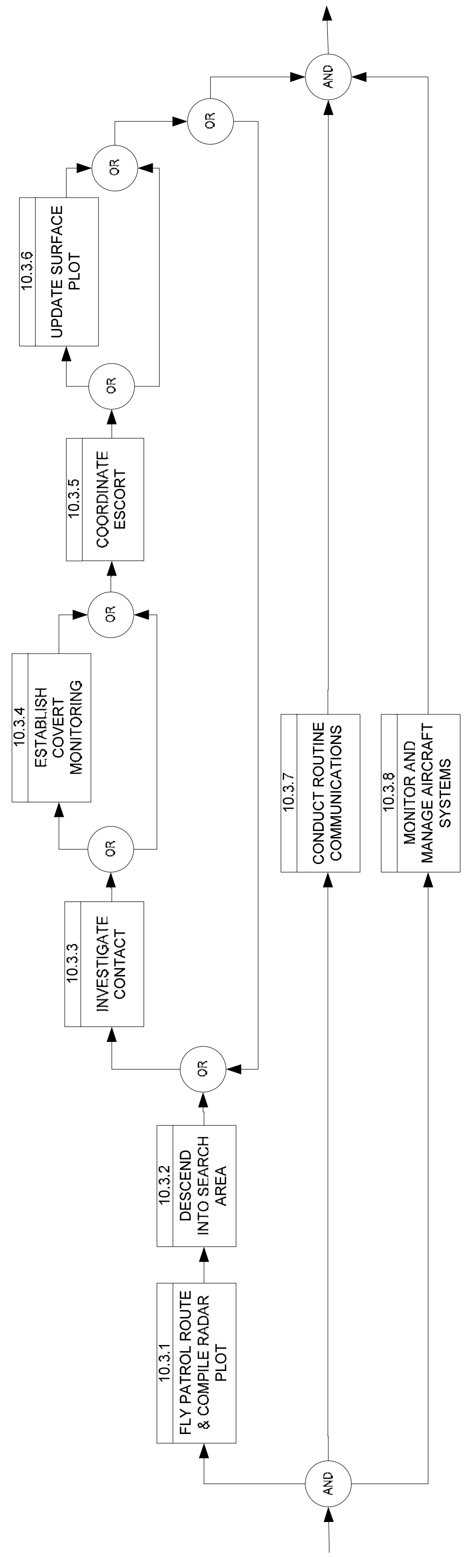

Figure 12. *CP-140 Convoy Escort*

Segment 10.3.2 – Descend into Search Area

As the CP-140 approaches the assigned search area, the pilot descends to a lower altitude depending on local conditions, type of enemy contacts (and weapon capability) expected in the area, and mission objectives (remain covert). The radar operator continues to update the radar plot. Any COIs are classified using a combination of radar and EO. Contacts classified as enemy are assigned the highest priority. If necessary, the pilot descends to an identification altitude and the crew conducts a radar homing to the first contact.

Segment 10.3.3 – Investigate Contact

As the CP-140 homes to the first contact, the crew begins gathering information about it using EO sensors. Aided and unaided visual means may also be used if the circumstances are permitting. When the contact has been identified visually, the pilot flies a pattern that allows the EO operator to record the features required by the tasking. This normally involves two or three passes. In determining the flight path for the recording runs, the pilot must consider the illumination available, the terrain around the contact and the features to be recorded. The AESOPs may verify that the recording was successful by replaying a portion of the last run.

Information is reported on ICS as it becomes available and the AESOP adds it to the appropriate contact file. The radar operator may be directed to offset the homing if visibility is low. The contact is identified by the AES observer. When the contact has been identified the AESOP annotates the contact file accordingly and the AES observer records it in a handwritten log.

If a contact is assessed as a threat, its position and MLA are logged and reported to the supporting LF. An EO recording may be made of the threat.

Segment 10.3.4 – Establish Covert Monitoring

Following identification of the threat, the CP-140 maintains a covert observation position. The optimum altitude, range and direction from which to monitor the threat are established depending on the atmospheric conditions and the illumination available. Ideally, the threat is monitored using EO, but if the weather conditions are unsuitable, it is tracked on radar. While the pilot is establishing the CP-140 in a covert observation profile, the location of the threat and a description of its activity are reported to LF assets.

Segment 10.3.5 – Coordinate Escort

The pilot maintains the CP-140 in a covert surveillance profile until PLE or relieved. The CP-140 crew transmits regular SITREPs to LF assets. The EO operator tracks the contact and records it continuously if conditions permit.

The radar operator may be directed to vector LF vessels into covert monitoring positions around the threat. The operator identifies the relevant contacts, and determines a suitable range from the contact for remaining covert, and then vectors them into position. The CP-140 crew reports any unusual activity to LF assets.

Segment 10.3.6 – Update Surface Plot

When the local threat has been investigated, the pilot climbs to the patrol altitude for the transit to the next contact(s) and to allow the radar operator to refresh the radar surface plot. New contacts are classified and the order of contact investigation is determined. This is also a good opportunity to conduct long-range communications if atmospheric conditions preclude communications during low level operations. After the plot has been updated and the communications requirements satisfied, pilot descends to investigation altitude and the radar operator conducts a homing to the next contact.

4.5.7 Segment 10.5 – Over-the-Horizon Targeting

Over-the-horizon targeting can be conducted by the CP-140 in support of engagements of enemy contacts by both naval forces and LF assets (i.e. artillery).

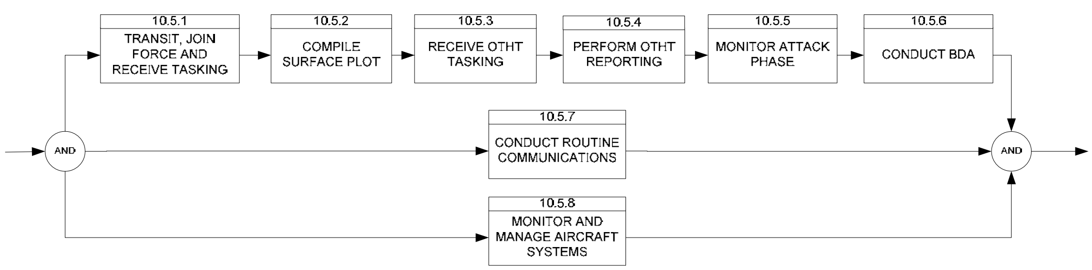

Figure 13. *CP-140 Over-the-Horizon Targeting*

Segment 10.5.1 – Transit, Join Force and Receive Tasking

Naval operations require that approaching aircraft identify themselves, or “join” the surface force. The CP-140 transits to a predetermined joining position and the AESOP or copilot contacts the surface force AAW coordinator and establishes the identity of the CP-140. The CP-140 is assigned a tasking by the surface force. The copilot enters a new waypoint into the FMS, and the pilot follows the steering commands on the FDI.

During the transit the AESOPs update the radar surface plot and prepare the mission systems for the tasking.

Segment 10.5.2 – Compile and Report Surface Plot

During the transit to the assigned search area, the AESOPs begin compiling the surface plot. The CP-140 remains at a suitable search altitude until the assigned area has been covered, and then descends to classification altitude (albeit, remaining a safe stand-off range or covert observation altitude). Contacts are classified using radar imaging modes and/or EO/IR. The surface plot is reported to the force using standard voice reporting format or datalink. The CP-140 may remain in the same area for the duration of the mission, or may be assigned to a new area when the tasked area has been covered.

Segment 10.5.3 – Receive OTHT Tasking

The CP-140 will be tasked to provide targeting information to friendly surface forces to support long distance engagements against enemy surface contacts.

Segment 10.5.4 – Perform OTHT Reporting

After receiving the tasking, the radar operator identifies the targets and firing units or attacking aircraft, and determines a suitable observation position and altitude. The pilot establishes the CP-140 in a loiter configuration at the observation position and the radar operator begins reporting the positions of the target vessels to the friendly force. The positions may be reported in absolute or relative terms. If OTHT is being performed, the firing units in the friendly force determine their individual firing times. The firing units fire based on the targeting information provided by the CP-140.

Segment 10.5.5 – Monitor Attack Phase

During the attack, the CP-140 will receive reports from the firing unit(s) including the launching of missiles. In turn, the CP-140 will report the beginning and completion of the attack based on feedback from the on-board sensors.

Segment 10.5.6 – Conduct Battle Damage Assessment

Upon completion of the attack, the sensor operators will use the imaging radar and/or EO/IR system to determine the extent of the damage inflicted on the target. The BDA report is completed and transmitted to the firing unit(s).

4.6 Off Task, Transit and Arrive at Base

As with the “Preflight, Departure and Transit” functional grouping, the “Off Task, Transit and Arrive at Base” functional grouping is a common activity for all missions. It begins when the aircraft has completed all of its assigned mission-related tasks, has been relieved by another aircraft or a vessel, and/or when PLE is reached and continues until aircraft shut down has been completed at base. Similar to the “Preflight, Departure and Transit” functional grouping, there are minor variations in the execution of these top- and first-level functions when comparing the FWSAR and CP-140 platforms.

4.6.1 SECTION 9 – En Route to Destination

The crew advises the controlling agency of the impending departure and contacts ATC to obtain the appropriate clearance back to base. Once cleared, the copilot selects the first waypoint on the route back to base for steering and the pilot begins to climb to transit altitude and turns toward the waypoint. The pilot initiates the off task checks to ensure that the aircraft and mission systems are reconfigured for the transit and that equipment is stowed. When the transit altitude is reached, the pilot levels off and continues to follow the waypoint steering information.

The transit phase at the end of a mission is naturally dependent on the location of the aircraft when the mission was completed. If sufficient time is available during the transit, the crew prepares the required post-flight reports or else these activities will be completed at base. The copilot carries out the routine navigation and provides progress reports to ATC. As the aircraft approaches destination, squadron operations and maintenance are contacted and an ETA and serviceability state is passed. During the transit the pilots perform weather and traffic avoidance as required.

4.6.2 SECTION 12 – Descent

In preparation for the approach, the aircraft will descend from its transit altitude and level off at an intermediate altitude. The appropriate checks are completed by the crew as part of the descent proceedings.

4.6.3 SECTION 13 – Approach Transition

Similar to the “Descent” function, the crew will plan a descent and approach in preparation for landing. The necessary preparations are performed prior to initiating the approach.

4.6.4 SECTION 14 – Approach

Depending of the weather conditions, the aircraft may conduct a Visual Flight Rule (VFR) or IFR approach to the landing runway. Approach clearance from ATC is obtained for the planned procedure. The pilot initiates a descent when cleared by ATC, and the pilots configure the navaids for the cleared approach. Pre-descent, pre-approach and pre-landing checks are completed. If an IFR approach is conducted the aircraft lines up for the active IFR runway and lets down in accordance with the selected instrument procedure until the non-flying pilot reports visual, or until minimums are reached and a missed approach must be executed.

4.6.5 SECTION 15 – Missed Approach/Rejected Landing

In the event of a missed approach, the aircraft may conduct further approaches or may elect to proceed to the alternate airport. If the non-flying pilot reports visual, the approach may be continued to the runway for a landing or may be broken off to proceed directly to a landing at the squadron ramp area.

4.6.6 SECTION 16 – Land

During the landing, the pilot controls the aircraft through its touchdown and subsequent braking. The aircraft is cleared from the runway and manoeuvred to the taxiway. Taxi clearance is obtained from the ATC.

4.6.7 SECTION 17 – Post-Flight Taxi

After landing the post-landing checks are completed. Clearance is obtained from tower or ground and the aircraft taxis to the parking position. The copilot contacts the tower to obtain clearance and to request a parking spot and marshaller. The pilot taxies to the parking spot on the cleared route and follows the marshaller's instructions to the parking spot. Checks may be conducted while the taxiing is in progress.

4.6.8 SECTION 18 – Shutdown and Debrief

The crew then completes the shutdown checklist to ensure that the aircraft and mission systems are shut down, before switching to ground power or APU power and then shutting down the engines. Finally, the crew departs the aircraft to complete the required servicing forms and flight records.

5. Task Analysis

5.1 General

The primary objective of the task analysis is to develop a database of AIMS-specific tasks with attributes. The resulting tasks are derived from the predecessor mission and function analyses and in turn define the functionality to be addressed as part of the AIMS OMI design effort. This helps to ensure the final AIMS OMI matches the operational requirements set forth by the mission objectives.

5.2 Gross Task Analysis

The conduct of the Task Analysis resulted in the development of a database that describes a set of task data elements for each unique task that is identified in the Task Inventory. The development of this database established the basis for the subsequent OMI design activities. Information related to the following task data elements was developed for each unique AIMS task:

a. task descriptions – short description of the task;

b. task initiating conditions – conditions that must be satisfied before the task can be initiated;

c. information required – information required by the human to complete the task;

d. actions required – actions to be performed by the human in completing the task;

e. frequency and tolerances of actions;

f. task completion times – estimates of the time required for the human to successfully complete the task; and

g. feedback required – feedback required to indicate successful completion of the task.

This comprehensive database provided the foundation for determining the types of controls and displays which would be most effective in permitting the operator to complete the required tasks.

5.3 Task Analysis Findings

Based on the results from the function analysis, the utilization of the AIMS system on-board the FWSAR and CP-140 aircraft was further examined. Regardless of the mission type and aircraft, there is a common set of lower level tasks that may be

performed by the operator when interacting with the system. To support the analysis, these tasks are grouped by both functionally and mission phase. The AIMS tasks as presented and subsequently analyzed in this report have been adapted from the original ALBEDOS and ELVISS analyses [References 17 and 19]. The task groupings are as follows:

a. **Pre- and post-flight tasks.** Deals with safely starting the equipment, confirming and adjusting settings for the mission, confirming proper operation of subsystems, and safely shutting down the equipment.

b. **Illuminator control tasks.** Address all aspects related to the control of the laser illuminator and the associated electronics that synchronize the operation of the laser with the low-light level TV (LLLTV) camera. Tasks include arming and activating the laser, selecting the divergence of the laser beam, adjusting the gate range and gate depth (automatically or manually), and setting the power level and pulse width of the laser beam. The operator must also be constantly aware of the illuminator status, divergence, gate range and gate depth when using the system.

c. **Camera and lens control tasks.** Includes all tasks related to the operation of the five cameras such as controlling (automatically or manually) the focus, FOV/zoom, electronic zoom, IR polarity, iris, repetition rate, filter, and all aspects of “gain”. The operator must also be aware of the status of these attributes at all times when using the system.

d. **Steering control tasks.** Includes selecting the system mode (manual, mosaic, scan), configuring mosaic mode parameters, controlling the pan and tilt for the AIMS stabilized platform, adjusting the pan and tilt sensitivity, slewing the turret to a pre-determined position, and controlling automatic scanning modes.

e. **Monitor and management tasks.** Addresses tasks associated with ensuring that the system continues to function effectively throughout the mission. The main conditions to be monitored by the operator are the platform drift, laser status, display status, and recording media status.

f. **Pre-search tasks.** Includes determination of the predicted weather for the search area and subsequent evaluation of the expected sensor performance. The search object identification features are determined and the search area terrain is reviewed. A search plan is established and briefed. The AIMS operator confirms the system serviceability and ensures the equipment is correctly configured.

g. **Search tasks.** Includes determination of the actual weather for the search area and subsequent evaluation of the actual sensor performance. The operator continuously monitors one or more of the camera images to detect possible search objects, and may slew the stabilized platform based on visual contacts or reports of possible contacts from other operators. The operator may initiate or terminate an automatic scan pattern (mosaic or auto scan modes) for the AIMS system as well as the auto-cueing function that focus the attention of human analysts to specific objects of interest within the incoming imagery. The operator maintains a record

of the sensor coverage of the search area, and maintains a general situational awareness of the nature of the terrain in the vicinity and the general search progress.

h. **Detection tasks.** Includes the sighting on the display of a possible search object, the initiation and termination of video recording, the determination and reporting of contact position, and the possible initiation of a contact information file.

i. **Tracking tasks.** Deals with the maintenance of a target in the camera FOV manually, the initiation of automatic tracking, the monitoring and manual adjustment of automatic tracking, and reporting the status of the tracking task.

j. **Classification and identification tasks.** Addresses tasks related to the monitoring and optimization of the contact image, and attempts to determine the precise nature of the contact. Identification may be limited to confirming that the contact is not the search object. The location of the contact may be marked for future reference, particularly if the identification cannot be achieved. Comments on the nature of the stored contact may be required. The outcome of the identification is reported to other crewmembers.

k. **Rescue site evaluation tasks.** Includes the determination of the nature of the terrain at the rescue site and an assessment of the associated hazards for an approach and/or landing near the site. It is assumed that the pilots are equipped with aided-vision systems which permit them to view the rescue site, and that the evaluation is a cooperative effort with the pilots assuming responsibility for hazards to the aircraft, and the AIMS operator assessing the hazards to the personnel that will be inserted into the rescue site. The AIMS operator maintains overall awareness of the operational situation, and reports significant observations with respect to the rescue site. Discussions as to the method of insertion, the best site for the insertion, and the planned sequence of events will generally be conducted between the crewmembers.

l. **Return transit tasks.** Includes the conduct of off-task checks and collection of data for post-mission analysis. The tasks are largely concerned with returning the equipment to the required pre-shutdown configuration and ensuring that images and video required for post-flight analysis are safely stored.

A complete list of AIMS tasks is found in Annex D, followed by task data sheets containing all pertinent information for each of the individual AIMS tasks.

6. Conclusions

6.1 General

This report presents the results of the MFTA carried out on the FWSAR and AIMP CP-140 aircrafts in support of the AIMS TDP. Previous analyses were used as a foundation with the current project extending the results by focusing on the integration of the AIMS system onboard the two aforementioned aircrafts. Of note, the analyses:

a. represent the operational roles and responsibilities of the FWSAR and CP-140 aircrafts;

b. characterize the anticipated use of the AIMS system within a spectrum of missions;

c. identify the tasks associated with the operation of the AIMS system; and

d. provide useful data that is applicable to the development of the AIMS OMI design.

6.2 Conclusions

Based on the results from the MFTA that analyzed the integration of the AIMS system onboard the FWSAR and CP-140 aircraft, it is concluded that:

a. the integration of the AIMS system onboard the FWSAR and CP-140 aircrafts will be used across a wide range of missions. Despite the variation in missions across the FWSAR and CP-140 aircrafts, there is significant commonality with respect to the employment of the EO/IR system.

b. the results of the task analysis are particularly important for ensuring that the usability associated with the AIMS OMI design is compatible with the anticipated usage of the AIMS system by the primary operators to support operational demands;

c. the results of these analyses should be considered during the integration of the EO/IR system as part of the FWSAR and AIMP CP-140 projects; and

d. these analyses have updated and extended a database of human factors information that can be shared by all participating in similar projects.

7. References

7.1 Mandatory References

1. MIL-STD-46855, Human Engineering Requirements for Military Systems, Equipment and Facilities, 26 May 1994.

2. MIL-STD-1472D (1991-Mar 20) Human Engineering Design Criteria for Military Systems, Equipment and Facilities.

3. NATO STANAG 3705, Human Engineering Design Criteria for Controls and Displays in Aircrew Stations, Parts 1 and 2. Brussels, NATO Military Agency for Standardization – Aircraft Instruments Panel.

7.2 Guidance Documents

7.2.1 Fixed Wing SAR Documents

4. Statement of Operational Requirements for the Fixed Wing Search and Rescue Project

5. Statement of Operating Intent for the Fixed Wing Search and Rescue Project

6. Fixed Wing Search and Rescue Aircraft Mission, Function, Task Analysis, and Crewmember Specialty Specification Development, FWSAR Subject Matter Expert Session, 21-22 June 2005

7.2.2 CP-140 Documents

7. CP140/CP140A Statement of Operating Intent, 15 March 2001.

8. Statement of Operational Requirements, Aurora Incremental Modernization, Version 1.1, 13 June 2001.

9. Aurora Update Functional Analysis and Allocation Report, CMC Document Number 1000-1019, 15 May 1992.

10. CP-140 Functional Definition Report, CMC Document Number 0680-1062, 18 October 1991.

11. Development of a CP-140 Overland Operations Capability – DRAFT

7.2.3 AIMS Documents

12. Advanced Integrated Multi-Sensing Surveillance TDP Requirements Specification (DRAFT)

13. Statement of Work for the Advanced Integrated Multi-Sensing Surveillance System Integration, DAEPM(R&CS)6.

14. Specifications for the Advanced Integrated Multi-Sensing Surveillance Sensor Package, 218R-15855-1, DAEPM(R&CS)6.

15. Statement of Work for the Advanced Integrated Multi-Sensing Surveillance Sensor Package, 218R-15855-1, DAEPM(R&CS)6.

7.2.4 Predecessor Systems Documents

16. SARPAL Human Engineering Design Approach Document – Operator, CMC Document Number 1000-1180, 12 November 1999.

17. ELVISS Human Engineering Design Approach Document – Operator, CMC Document Number 1000-1182, 28 April 1999.

18. Development of an Operator-Machine Interface for ELVISS, DRDC-Toronto Technical Report Number TR 2004-055, 2005.

19. ALBEDOS Human Engineering Design Approach Document – Operator, CMC Document Number 1000-1140, 20 March 1998.

20. ALBEDOS Human Factors Usability and Test Protocol Review: Notes and Observations, Unger Campbell and Associates, 17 August 1997.

21. A Human Factors Evaluation of the ALBEDOS Human-Machine Interface for Search and Rescue, Defence and Civil Institute of Environmental Medicine (DCIEM) Report Number 96-R-44, July 1996.

22. Wescam MX-20 Product Overview, L3 Communications Document Number 60916 Rev XC, 24 February 2004.

7.2.5 Predecessor HFE Platform Analyses

23. Canadian Forces Search and Rescue Helicopter Human Engineering System Analysis Report, CMC Document Number 1000-1090, 16 May 1995.

24. Coastal Patrol Aircraft Mission Description and Functional Analysis Report, CMC Document Number 1000-1028, 12 August 1993.

7.2.6 General SAR Documents

25. National Search and Rescue Manual, Department of Fisheries and Oceans (DFO) 5449, B-GA-209-001/FP-001, May 1998.

26. Federal SAR Program Plan 2004, National Search and Rescue Secretariat, December 2003.

7.2.7 Miscellaneous Documents

27. Allied Administrative Publications (AAP) 6, NATO Glossary of Terms and Definitions, 2002.

28. 1994 White Paper on Defence, http://www.forces.gc.ca/admpol/eng/doc/white_e.htm

Annex A Mission Scenarios

A.1 FWSAR Mission Scenarios

Mission scenarios for the FWSAR aircraft are resident in Annex D to the FWSAR SOI [Reference 5].

A.2 CP-140 AIMP Mission Scenarios

With respect to investigating the employment of the AIMS system on the CP-140, the following four scenarios have been developed:

a. SAR – Overland and Arctic;

b. Fisheries Patrol;

c. Surveillance of Targets and OTHT.

The selection of scenarios was chosen to reflect the diversity of CP-140 missions. To that end, the scenarios illustrate the potential utilization of the AIMS system with respect to:

a. Entire spectrum of mission activities beginning with the pre-start and pre-takeoff phases and ending with the approach and landing phases;

b. Peacetime operations such as SAR to wartime operations in support of other friendly forces to conduct OTHT and BDA; and

c. Detection, classification, identification, and tracking of COIs over land and over water.

A.2.1 Scenario 1: SAR – Overland and Arctic

This mission involves the launch of a CP-140 aircraft to search for missing, overdue or otherwise distressed search objects over the landmass of Canada. This type of mission can be conducted at any time of the day or night, in all weather conditions, in any area in Canada, and may occur on any day of the year.

Based on discussions with the CP-140 community at MP&EU at CFB Greenwood, this scenario has been adapted from a FWSAR SAR – Overland and Artic scenario [Reference 4] for performance by the CP-140.

Situation

The CP-140 aircraft is tasked on a weekend day in October for an overdue aircraft on a flight plan from Edmonton City Center Airport to Regina, via Saskatoon and Moose Jaw. The tasking occurs at 1430 local, and the crew is on a two-hour Standby posture. Details of the mission are as follows:

a. Nature of Distress: Overdue Aircraft

b. Aircraft Type: Cessna 172

c. Characteristics: High wing, fixed tricycle gear, prop driven monoplane, white with red stripe, Call-sign C-GPDM

d. Aircraft Equipment: VHF, Transponder, VOR, ADF, handheld GPS

e. ELT: Narco 10 – 121.5

f. Persons on board: Four (4) – 25yrs female (pilot), 27yrs male (aircraft owner), 44yrs male (passenger), 49yrs female (passenger), all in good health. Older couple is aunt and uncle of aircraft owner and pilot, who are husband and wife. Pilot is VFR only. Aircraft is certified for VFR flight only, though does have minimal IFR instrument suite required by civil certification laws.

g. Flight Plan: VFR

h. Routing: CYXD CYXE Hwy 2 Moose Jaw Hwy 1 CYQR

i. Last Known Position (LKP): 15 NM East of Edmonton at 1730Z

j. Time En route: 1.5 hours

k. Weather: VFR in Alberta, MVFR (Ceilings 1800-3000’ from 50 NW of CYXE for remainder of flight. Some snow showers reported decreasing visibilities to 1 mile) in Saskatchewan

l. Reported overdue by: Regina ATC on expiration of flight plan alerting time (1 hour after estimated time of landing noted in flight plan)

m. Preliminary investigation completed: Aircraft departed on time at just before 1700 UTC, called clearing the zone at 1723 UTC with Edmonton ATC. Radar contact lost in ground clutter at 1735, at indicated altitude of 3660’ MSL in apparent level flight. No radar contact from Saskatoon established, and no other radio transmissions heard en route. Checks of CYXE, MJ Muni and CYMJ, as well as CYYN (Swift Current) were negative. No distress calls heard. SARSAT negative, no high-flyer reports of ELT.

JRCC determines the most probable area between Edmonton and Saskatoon, as neither radar nor radio contact was established in Saskatoon. JRCC wishes CP-140 aircraft to conduct a survivor search for the missing aircraft as soon as possible. Aurora is on 2hr Standby since the primary SAR aircraft is not available.

Chronological Sequence of Events

Table 1. *CP-140 SAR Scenario – Chronological Sequence of Events*

TIME	EVENT
T+1	AC receives notification by pager from Wing Operations (WOPS) to call in for information.
T+8	AC contacts WOPS by telephone. WOPS notifies AC of potential tasking from JRCC Trenton for overdue aircraft.
T+10	AC contacts JRCC Trenton via cell phone while en route to squadron, receives tasking details as outlined above, gets preliminary weather information for search area. JRCC indicates tasking message will be prepared and faxed. AC advises JRCC that the plan would be to fly the route in reverse, from Regina to Saskatoon, at higher altitude and high speed, making blind broadcasts and listening for distress beacons throughout, thence commencing a survivor search from Saskatoon to Edmonton. JRCC concurs with the plan.
T+14	AC accepts tasking from JRCC (time of acceptance indicates beginning of 2 hour maximum window to get aircraft airborne). JRCC initiates 'gang' page of remainder of crew, as well as maintenance personnel through WOPS. WOPS initiates flight feeding requirements through appropriate messes.
T+20	AC arrives at squadron, changes into flight clothing, and prepares personal equipment. Crew day begins with arrival of first crewmember at squadron.
PRE-FLIGHT	
T+22	Maintenance personnel tow aircraft from hangar, conduct before flight checks (B-check) not previously completed, ensure maintenance record set (MRS) and armament state are accurate. All checks are valid and signed off.
T+23	AC initiates initial flight planning considerations, receives tasking message from JRCC, remainder of crew arriving sporadically and assisting. AC contacts WOPS to ensure all crewmembers have responded to page and are en route. AC requests additional armament load (10 flares) be added to standard complement.
T+29	All crewmembers have arrived at squadron and changed into operational clothing. AC consults with FE on fuel load to determine adjustments to standard if required. FE conducts weight and balance computation as required. All crewmembers load personal gear. FO ensures publications on aircraft cover required area both VFR and IFR, prepares K1017, loads cameras, sat phone (portable) and cell phone. FO updates map data transfer module (DTM).
T+30	Maintenance personnel initiate preparations of backup aircraft. On the primary aircraft, FE conducts thorough pre-flight inspections on all aircraft systems, stocks BMS if required, stows flight meals, removes all covers, plugs and locks, and reviews MRS.
T+32	Crewmembers load personal gear, SAR mission kit as required, medical supplies from storage, and ensure armament state sufficient for mission. In addition, crewmembers conduct pre-flight checks of all SAR equipment as required, assist FE in cargo-compartment preparation, review pertinent

Table 1. *CP-140 SAR Scenario – Chronological Sequence of Events*

TIME	EVENT
	info/protocols for specific mission, and review medical condition of distressed persons if required.
T+30-50	Pre-flight preparations completed, routing determined, NOTAMs checked, flight plan filed by TACNAV following review by AC. MRS signed out by AC after review by FE, verifies armament state and signs K1017. NAVCOM contacts JRCC (via MACS) for update, and informs them of impending launch with estimated on-scene time for CYXE. TACNAV loads all pertinent data into GPS/FMS/Sensor DTM for transfer to aircraft. TACNAV prepares additional search maps and finalizes fuel calculations, grabs additional search maps as required. Flight meals arrive from mess.
T+51	Crew briefing conducted by WOPS duty officer. Crew suggestions solicited, plan confirmed and briefed to the crew by the AC. TACNAV prints the latest weather information prior to walking to the aircraft.
T+56	Crew 'steps' to the aircraft. Technicians (Start Crew) pull the aircraft chocks and conduct 'last-chance' check.
PRE-START AND START	
T+1h	Pre-start check initiated by flying pilot. Co-pilot contacts ATC for start clearance via VHF-AM and initiates IFR clearance request from clearance delivery. Automatic Terminal Information System (ATIS) is obtained (airfield information for flight operations and latest weather sequence). APU is started.
T+1h3 – T+1h7	Pre-start/Engine-start checks initiated by FO. Aircraft started, ramp/door closed, post-start/pre-taxi check initiated. Systems energized including all radios, radars (standby/warm-up mode), transponder (standby mode), sensors, radar altimeter, lighting, GPS/INS/FMS, multi-functional displays, gyro instruments, etc. AC/FO conduct verification checks on radios, navaids and instruments for IFR/VFR flight. Crewmembers conduct checks of their station equipment, ensure sensor systems calibrated and cameras are functioning, and verify radar functioning through BIT. APU is secured.
PRE-FLIGHT TAXI	
T+1h10	AC requests taxi clearance to departure runway. Taxi checks completed including verifying compass and IFR instrument are in accordance with regulations. Brakes checked. IFR clearance accepted and recorded by crew.
T+1h12	Pre-takeoff check actioned. Trims, flaps set. Flight controls checked, radios/navaids set for departure, FMS programmed as required, anti-skid armed, props set full fine (if required), torque determined by FO and briefed, Anti-icing equipment tested and selected as required, departure procedure briefed by flying pilot for given weight considerations, harnesses secured for all crewmembers. TACNAV briefs outbound radial, minimum safe altitude and en route altitude. FO activates radar for departure.
TAKEOFF AND INITIAL CLIMB	
T+1h15	Aircraft departs and maximum torque is set. Post-lift-off (at safe speed), landing gear retracted, flaps retracted, climb power set. Post-takeoff check (Condition 4) completed by ASO and NASO-3. FE conducts cabin-compartment/wing check. NAVCOM contacts MACS via UHF radio to advise airborne and estimated time on scene.
T+1h16-T+1h25	Departure procedure is flown using GPS/INS/FMS guidance and navaids. Climb checks are completed. Through FL180 altimeters are set to 29.92" (transition).

Table 1. *CP-140 SAR Scenario – Chronological Sequence of Events*

TIME	EVENT
EN ROUTE	
T+1h30	The aircraft levels at 22 000 ft and the AC calls level with ATC. The radar is adjusted for en route flight for traffic and weather avoidance. FMS programmed and navaids adjusted as appropriate. De-icing equipment selected to shed ice accretion from climb. (Including prop and wings/tail) During transit, outbound checks (Condition 3) conducted by each crewmember.
T+1h31 – T+2h50	During en route flight to Regina, the aircraft descends to FL 220 (Deviation from routing for traffic requested by ATC). Fuel is monitored and recorded by FE. Routing/navaids adjusted as required. An update on SARSAT information (Negative) from JRCC Trenton is received via MACS. Radar automatically adjusts to optimize weather-avoidance. TACNAV briefs the search plan to the crew. Occasional light turbulence is encountered throughout the flight. A minor electrical snag is displayed on the Advisory, Caution, And Warning System (ACAWS). FE troubleshoots and rectifies the problem. Weather is updated at regular intervals (new reports are issued each hour at the top of the hour, new forecasts every 4-8 hours or as required by significant variance) for en route airports and destination.
T+2h51	Weather for CYQR received, ATIS also obtained for landing information. AC initiates descent to 14,000' for flight from Regina on reverse route. The radar operator adjusts the radar parameters in preparation for descent. Spotters (NASO-3 and acoustic operators) prepare to commence visual searching (if able i.e. Out of cloud). De-icing/anti-icing selected/deselected as required during descent.
T+3h	The aircraft receives ATC clearance for routing beyond Regina. Flying pilot initiates pre-search check. TACNAV briefs the search including the following: • Nature of Emergency – Overdue aircraft; • Search Object – What the search is for. Type of potential signs for spotters, colour of object and physical features, signalling devices, etc.; • Persons on Board (POB) – number of persons in distress; • ELT – Type, frequency, SARSAT updates; • Assigned search area – brief description of search area, terrain, vegetation, elevation, hazards; • Search type – type of search and coverage desired; • Search speed – speed to conduct search, including configuration and altitude; • Communications – primary/secondary frequencies, reporting requirements, OSC, blind-broadcasts; • Other Units – other ground and airborne assets in the area, their location and deconfliction planning, capability (helicopter support for rescue plan); • Bingo – VFR and IFR bingo fuel and destination; and • Overall plan and timings for search, and preliminary rescue plan. • Homing/detection equipment selected for optimal reception and functionality checked with

Table 1. CP-140 SAR Scenario – Chronological Sequence of Events

TIME	EVENT
	ATC. On-station checks are completed by the crew. NAVCOM advises JRCC (via MACS) that aircraft is 'on-scene' at time 2344Z and commencing electronic search.
T+3h04	Aircraft levels at 20 000 ft (still in the clouds). Pilot briefs crew on the local weather conditions. AC commences blind broadcasts on 121.5, 126.7 and local frequencies. The EO/IR operator configures the EO/IR system while the radar operator optimizes the radar parameters for searching given the local conditions. Clouds are too thick to penetrate with sensor cameras.
T+3h11	Aircraft turns north from Moose Jaw towards Saskatoon. Fuel checked and time compared against flight planned times. AC leaves seat to use washroom facilities and get some supplemental nutrition and coffee.
T+3h20	Flight meals distributed and consumed by AC and other crewmembers.
T+3h36	Flying pilot initiates post-search check, followed by approach check. Type of approach selected and briefed by flying pilot (approach, minimums, overshoot, radios/navaids, timings/transition, speeds). TACNAV briefs inbound track, step-down and minimum-safe altitudes from E-Flt pubs presentation, advises of initial timing to be updated on final.
T+3h45	Descent is initiated to transition approach altitude, requested and approved by ATC. Altimeters are reset to local airfield (Saskatoon, CYXE) setting, also called QNH. De-icing/anti-icing selected/deselected as required during descent. Radar adjusts automatically for descent.
T+3h47	Through 12 500 ft aircraft leaves class B airspace, routing via vectors from ATC to final approach in CYXE. Pre-landing check initiated and actioned. Landing gear and flaps selected down on final approach.
T+3h55	Aircraft breaks out of cloud at 2000' AGL (3700' MSL). AC requests cancellation of IFR clearance and proceeding via VFR. Lighting adjusted for approaching darkness.
CONDUCT SEARCH	
T+4h05	NAVCOM advises JRCC (via MACS) of aircraft location and commencing survivor-search portion of flight via SATCOM (hourly update). Each sensor operator optimizes their respective sensor (e.g. NASO-2 optimizes radar for ground mapping). The updated search plan briefed by TACNAV and the aircraft is re-configured for searching. The co-pilot adjusts flight plan timings, and re-files VFR flight plan with Saskatoon ATC agencies, making Edmonton International Airport (CYEG) the destination field. The aircraft is slowed to 180 kts to conduct visual search. Descent and climb initiated as required to maintain 1500-2000' AGL en route to Edmonton.
T+4h06- T+4h47	Search conducted from CYXE to CYXD, including blind broadcasts en route. The EO/IR operator continually monitors the EO/IR system and studies incoming imagery. The sensor equipment is searching and detecting, but there is no indication of the search object. Spotters commence use of Night Vision Goggles (NVGs) once total darkness ensues. Aircraft altitude adjusted to maintain 2000' above highest obstacle within 5 NM of track once full night conditions arrive.
T+4h48	A weak ELT signal is heard through dedicated receiver. The signal is not strong enough to use homing equipment; therefore, TACNAV directs aural homing procedure. TACNAV begins triangulation using DMSA. Location and time recorded in electronic search log. Location saved in GPS/FMS waypoint database and on moving map (DMSA) at EO/IR station as well. The aircraft continues on track until the signal is lost. The time and location are noted and stored in FMS. AC requests and FO initiates climb to 5000' AGL (7000' MSL) for better signal. Squelch is adjusted on other radios and deselected on VHF 121.5. The signal is regained at the higher altitude and the aural homing procedure is re-initiated by

__Table 1.__ CP-140 SAR Scenario – Chronological Sequence of Events

TIME	EVENT
	TACNAV. Local terrain, elevation and any facilities in the area are noted using the DMSA. NAVCOM contacts JRCC via MACS with updated information and advises of ELT signal, requests updated information on helicopter assistance. AC notes endurance remaining. Spotters continue visual spotting, commence preliminary preparations for rescue.
T+5h04	TACNAV conducts hourly check-in with JRCC via MACS using teletype text message, advises ELT signal heard and further investigation ongoing.
T+5h12	As aural null continued, signal becomes stronger just North of track. Homing equipment used to pinpoint location. Location saved as waypoint in GPS and on moving map. Aircraft orbits while spotters view area. NASO-1 utilizes the EO/IR camera to identify what appears to be a crashed aircraft, nosed over in a field, with one wing partially torn off. Two people are noted waving in the area, attempting to signal with a flashlight, which is picked up by the spotters on NVGs as well as by IR camera. Radio contact is attempted with unsuccessful results. NASO-1 maintains the EO/IR sensor on the crash site and survivors. Preparations in rear of aircraft commence for aerial delivery, and prepare stores control and dispensing system for dispatch of flares. FO descends aircraft for low overflight to ensure distressed party is aware that they have been located. NASO-1 takes detailed photographs and video of both EO and IR images of crash site and surrounding area.
T+5h25	NOCL message passed to JRCC (via MACS) using the teletype text messaging, indicating the location and nature of the crashed aircraft (with confirmed callsign) and requesting immediate helicopter support. Pre-drop checks initiated by FO, and aircraft configured for aerial delivery (aircraft slowed, flaps extended, ramp/cargo door opened). FE dons safety harness and helmet and rigs winch. Drop briefings completed by FO and TL. Aircraft established in 'holding' pattern at 4500' AGL (6500' MSL) to set up for flare dispatch. Crewmembers rig medical bundle and miscellaneous equipment for delivery to crash location, including lighting and 'screamers' in order to easily retrieve the equipment on the ground. AC determines best location to conduct aerial delivery. Relatively flat terrain simplifies this procedure. AC/FO determines upper winds and surface winds using all available means.
T+5h35	JRCC approves request to dispatch SKAD. Advises that Helo assets are en route, ETA for Helo assets is 1 hour and 30 minutes.
T+5h38	LUU 2B Para-Flares dispatched from stores control and dispensing system (SCDS) after arming by AC to observe crash scene from 4500' AGL. Terrain and target assessment completed. TACNAV calculates Flare-Release point and inputs into the mission computer. Aircraft descends and sets up in orbit at 500' AGL. Aircraft flown into wind, over target area, and drift light dispatched. Aircraft flown over drift light, over target, and SKAD dispatched. Ramp/cargo door closed. FO orbits area to observe SKAD drift-down. NASO-1 observes SKAD drop using EO/IR sensor.
T+6h15	NAVCOM advises JRCC (via MACS) using the SATCOM text message, advised that helicopter is one hour back. FE recalculates Bingo fuel, determines that CP-140 has only 30 minutes until Bingo fuel is reached, advises AC.
T+6h18	Post-drop check completed. Aircraft secured (ramp closed) and cargo-compartment secured for transit. Flares remain at the ready in SCDS in case illumination of ground-scene is required.
T+6h25	AC advises NAVCOM to get latest weather in Edmonton and Saskatoon. AC contacts WOPS via SATCOM and provides SITREP. NAVCOM contacts MACS and gets weather update. NAVCOM updates electronic search log, prints out weather information on printer and hands up to pilots for review in cockpit.
T+6h30	Decision to proceed to CYXE as final destination is made. TACNAV updates flight plan information to reflect destination as CYXE with ATC agencies. FO communicates on local air traffic frequencies.

Table 1. *CP-140 SAR Scenario – Chronological Sequence of Events*

TIME	EVENT
T+6h45	AC contacts JRCC with updated NOCL on SATCOM. JRCC advises that ground teams are en route but will likely arrive after the helicopter. AC gets appropriate frequencies to contact helicopter, and asks JRCC to investigate local hospital options for Helo landing and casualty care.
T+6h53	NAVCOM contacts helicopter via HF, then changes over to company UHF frequency. NAVCOM advises helicopter of on-scene weather, elevation, flight conditions and salient terrain features which may impact hoisting requirements, as well as closest hospital facilities with helicopter access (North Battleford, SK). NAVCOM also indicates that CP-140 will RTB in 7 minutes for fuel, destination CYXE and advises ground team en route (RCMP).
T+6h59	AC advises outbound track to CYXE, and climb to 16,000' for best forward speed. Sensor operators deselect sensor equipment and recording devices. NAVCOM contacts JRCC (via MACS) using SATCOM datalink to advise that CP-140 is 'off-scene' and RTB CYXE at this time. Updates search log, re-adjusts radar for climb, enters route into FMS for AC review. AC advises helo that CP-140 is 'off-scene'.
EN ROUTE TO DESTINATION	
T+7h04	Climb initiated to 16,000'. Remainder of cargo compartment secured. Post-search check completed (as required). De-icing equipment selected, blind broadcasts completed in uncontrolled airspace.
T+ 7h 09	Climb checks completed. Approaching cloud bases, AC contacts CYXE terminal on VHF radio, gets IFR clearance to CYXE at 16,000'. AC squawks 'Ident' on IFF for radar identification. Aircraft enters cloud at 7400' MSL.
T+7h16	Aircraft levels at 22,000 ft, AC advises ATC, autopilot engaged by FO. Co-pilot contacts CYXE radio via VHF for latest weather update and passes the updated to AC. All crewmember retrieve appropriate page of GPH 200 instrument approach for CYXE on eFlt pubs display.
APPROACH	
T+7h36	FO (Flying pilot) initiates approach check. Type of approach selected and briefed by flying pilot. AC briefs inbound track, step-down and minimum-safe altitudes from chart, advises of initial timing to be updated on final. FE briefs overshoot torque if required.
T+7h45	Descent initiated to transition approach altitude, requested and approved by ATC. AC confirms status and selection of airfield lighting and Canadian Runway Friction Index (CRFI) condition with ATC. Altimeters reset to local airfield (Saskatoon, CYXE) setting, also called QNH. De-icing, anti-icing selected/deselected as required during descent. Radar adjusted by NASO-2 for descent. FO initiates pre-landing check, and harnesses secured by all crewmembers for approach.
LAND	
T+7h47	Through 12,500' aircraft leaves class B airspace, routing via vectors from ATC to final approach in CYXE. Pre-landing check actioned. Landing gear and flaps selected down on final approach.
T+7h51	Timing started at final approach fix (updates to timing as required for winds). Final check initiated and actioned, including confirmation of landing gear position and selection of landing lights 'on'. AC flies approach (PMA) from RH seat, FO monitors and takes control for landing.
T+7h43	Landing clearance received and acknowledged by ATC. L/G position re-confirmed by pilots to be down and locked.
T+7h55	Aircraft breaks out of cloud at 450' AGL (2100' MSL). FO takes control from AC for landing. On landing, spoilers actuated, reverse initiated by FO, brakes applied.

Table 1. *CP-140 SAR Scenario – Chronological Sequence of Events*

TIME	EVENT
POST-FLIGHT TAXI	
T+8h00	Aircraft finishes after-landing rollout. Post-landing check initiated by FO. Flaps retracted, spoilers secured, landing lights switched off and taxi lights selected on. All systems selected to off or standby as required. Taxi clearance to FBO requested and received by AC from ATC. Flight plan closed on VHF 2 through FSS. Ramp/cargo door opened to taxi position by SAR Techs.
T+8h06	CP-140 arrives at parking. Marshalled in by FBO staff. Once stopped, parking brake set. Post-landing check completed, shutdown check initiated. Ramp/door fully opened, all remaining systems turned ‘off’ including taxi lights. Internal lighting adjusted for aircraft exit. APU started as required. Engines shutdown and secured. Once engines stop and propeller stops, all electrics turned off.
SHUTDOWN AND DEBRIEF	
T+8h10	FE chocks aircraft. AC signs in MRS, indicating new armament state and serviceability. K1017 is completed to include all pertinent timings, records in electronic Search log for post-mission report. SAR Techs assist FE in securing cargo compartment and installing plugs/pins as required. FO replenishes publications, liaises with FBO staff on all requirements. AC or NAVCOM liaise with JRCC on ‘way ahead’ for rescue efforts.
T+8h27	JRCC informs CP-140 crew that rescue was successful. AC decides that based on crew day, time of day, etc. that the aircraft will remain over night in CYXE. Preparations made through FBO for hotel/transport.
T+8h35	FE conducts an A check and secures the aircraft for overnight (locked). Install wing and tail covers to prevent icing. FE conducts appropriate inspections on aircraft and signs MRS reflecting completion of checks, downloads IHMS data to laptop from DTM. AC leaves contact information with FBO and advises of incoming Griffon helicopter and requirements. Advises that departure will be in approximately 15-18 hours time depending on arrival time of SAR Techs. NAVCOM advises JRCC Trenton of intentions and contact information. FO phones WOPS Winnipeg and informs them of entire plan and ETA home base.
T+9h07	Crew departs for downtown hotel location. Informal crew brief conducted en route. Crew prepares preliminary mission report for JRCC. FE faxes MRS information and armament state back to Squadron Operations.
T+9h30	Crew arrives at hotel. AC advises crew that they will be contacted in the morning (in about 12 hours) to advise of further plan and departure time.

A.2.2 Scenario 2: Fisheries Patrol

This type of peacetime mission is commonly conducted by the CP-140 at any time of the day or night, in all weather conditions, in any area in Canada, and may occur on any day of the year. The following FISHPAT scenario has been adapted from Reference 24 to illustrate the utilization of the AIMS system for a mission over water.

Situation

This scenario takes place over the Atlantic Ocean east of Nova Scotia and south of Newfoundland, and over the Bay of Fundy and New Brunswick. It is the late spring. There is concern about over-fishing, both inside and adjacent to Canada's 200 NM economic zone. A CP-140, based at CFB Greenwood, has been tasked to conduct a peacetime patrol of the fishing activities off the southeast coast of Newfoundland. This is an area in which the Grand Banks extends several miles outside the Canadian 200 NM limit. It has been the centre of the controversy because foreign vessels may fish in the area without a licence. Without the restrictions of the licensed fisheries, these vessels often take far more fish than can be replaced through natural processes. Also, unlicensed vessels sometimes follow the fish across the line into the regulated fishery.

The CP-140 will detect, classify and identify all fishing vessels within a 100 NM by 100 NM area centred on the tail of the bank. The fishing activity of each vessel will be noted and recorded. The licences of all vessels operating inside the 200 NM limit will be verified, and unlicensed vessels observed to be fishing will be documented and reported.

Chronological Sequence of Events

Table 2. *CP-140 FISHPAT Scenario – Chronological Sequence of Events*

TIME	EVENT
PRE-FLIGHT	
2015	The pre-flight mission briefing has been scheduled for 2030 at WOPS. The crew gathers at the mission planning centre to sign for publications and equipment. CP-140 crewmembers and the DFO officer review the tasking message and discuss mission requirements prior to the briefing.
2030	The operations officer begins the mission briefing by introducing the MET forecaster who provides a briefing on the weather in the patrol area at the destination airfield and three alternates. The weather will be IFR for departure, with several overcast layers between 1000' and 12,000'. The sunset will be at 2103 hours. The forecast for the patrol area is for ceilings between 2000' and 3000', and variable visibility from 2 to 10 NM or partially obscured in intermittent snow showers. The sea state is expected to be 2 to 3. At the anticipated landing time the airfield is expected to be near minimums with morning ground fog and a ceiling of 2000'. The MET briefer gives the MC a package containing

Table 2. *CP-140 FISHPAT Scenario – Chronological Sequence of Events*

TIME	EVENT
	the latest actuals and forecasts for the patrol area, CFB Greenwood, and several alternate airfields. The DFO officer outlines the fishery patrol mission. The assigned area is a 100 NM square centred on the “tail of the bank”. The contacts of interest are vessels engaged in fishing within 10 NM either side of the 200 NM limit, other vessels engaged in fishing, and then any other fishing vessels, in that order of priority. A DFO vessel, the Chebucto, is also in the area, and is to be contacted at the On Station point. The operations officer then brings the crew up to date on any other contacts of interest which are known or suspected to be operating in the vicinity of the assigned patrol area.
2100	The crew, including OGD personnel, meets in the mission planning centre after the briefing. The fishery patrol is a routine one that does not require much discussion. The L/AESOP briefs the crew on the expected detection, classification and identification ranges for different sized contacts using EO, radar and visual observation. The AESOPs then proceed to the aircraft, carrying the publications and codes, mission software, and the hand-held camera, while the pilots, accompanied by the DFO officer, proceed to the flight planning centre with the flight publications.
2110	At the flight planning centre, the copilot prepares the navigation flight plan and the pilot checks NOTAMS and prepares the IFR flight plan. The copilot determines the CADIZ penetration points and times and reports them to the pilot, who incorporates them into the IFR flight plan. The pilot files the flight plan, and then the pilots and DFO officer head for the maintenance centre. Meanwhile, the remaining crewmembers board the CPA and stow personal equipment and the carry-on mission equipment.
2115	After ensuring that electrical power is available, the central computer is loaded, the IR cooling is initiated, and mission systems are checked in accordance wit h checklists. The EO/IR operator exits the aircraft to inspect the sensor installation. The EO turret windows/lenses are checked visually and cleaned if necessary. The EO/IR operator returns on board and when IR cooling is complete, checks the IR system using a suitable target.
2120	The MC inspects the AMRS at the maintenance centre, signs for the aircraft completes the Record of Flying Time. He then proceeds out to the aircraft along with the copilot and the DFO officer.
2130	The pilots and the DFO officer arrive on board the CPA and stow their personal equipment. The DFO officer is assigned to the lookout station for take-off. The pilot performs an external walk-around, and then consults with the crew on the progress of the PFI and the serviceability of the mission systems. The copilot initializes the FMS and begins entering waypoints for the planned route. The copilot also calculates the take-off speed based on ambient temperature and aircraft weight.
2140	The pilot assists the copilot to complete the flight deck PFI, including checking the flight instruments, the flight controls, and configuring the communications systems for the anticipated taxi, take-off and departure procedure.
PRE-START AND START	
2145	The MC initiates the pre-start check. The copilot advises the tower of the engine start, and the pilots start the engines. When electrical power is available, the ground power unit is removed by the start crew at a signal by the pilot. The crew conducts the pre-taxi check.
2150	The copilot obtains clearance to taxi and requests airways clearance from ATC. The pilot begins to taxi the aircraft to the hold position of the active runway. During the taxi, the pilots monitor the flight and engine instruments and test the brakes and thrust reversers. The radar operator checks the radar serviceability after the pilot or copilot advises that the aircraft is clear of all people, vehicles and buildings. The airways clearance is given by ATC and read back by the copilot during taxi.
2155	As the CP-140 arrives at the hold position, the copilot advises ATC that the aircraft is ready for departure. The crew completes the pre-take-off check while waiting for take-off clearance, ensuring that the appropriate navaids are selected, that the anti-icing systems are activated if required, and

Table 2. *CP-140 FISHPAT Scenario – Chronological Sequence of Events*

TIME	EVENT
	that the flaps are properly set. The radar operator optimizes the radar for traffic, weather and obstacle avoidance during departure. When ATC clears the CP-140 for take-off, the pilot gives the departure brief, including take-off speeds and emergency procedures. The pilot lines up on runway heading. A final compass comparison is made and then the pilot advances the throttles.
TAKEOFF AND INITIAL CLIMB	
2200	As the aircraft gathers speed, the pilot uses nosewheel steering to hold the aircraft on runway centreline until the flight controls take effect. The copilot monitors the progress of the take-off and the engine and flight instruments. The CP-140 is airborne on time.
2201	After the aircraft becomes airborne, the pilot calls for the Post-Take-off Check. The landing gear and flaps are retracted and the departure procedure is initiated. The take-off time is reported to WOPs. The radar operator monitors the radar display for other air traffic, weather and obstacles. When the CP-140 is above the safety height and is clear of conflicting traffic, a visual inspection of the interior compartments is performed for heat build-up or fire, as well as a check of exterior features such as the wings and engines for evidence of icing, damage or fire. The pilot flies the departure procedure, backed up by the copilot who also maintains communications with ATC.
2202	The departure includes a restriction to remain at 3000’ until 15 NM from the airfield VOR. The pilot levels off at 3000’.
CLIMB	
2205	At the completion of the departure procedure, the copilot informs ATC that the aircraft has complied with all restrictions. ATC clears the CP-140 to climb en route, and the copilot selects the first en route waypoint for steering. The pilot turns toward the waypoint and resumes climbing to transit altitude of 22,000’. The radar operator reports the radar serviceable and continues to monitor the display for other traffic and weather. The EO/IR operator confirms the serviceability of the IR and LLLTV sensors and reports the results to the MC. The copilot conducts the navigation accuracy checks, noting and logging the GPS FOM and the ONS geometry and SNR. Radios are configured for secure voice communications.
TRANSIT	
2222	The pilot levels off at top of climb, sets the throttles for economical cruise speed, and maintains steering to the next waypoint. The copilot reports the flight level and position to ATC and passes an estimate for the descent point, at which time the CP-140 will leave controlled airspace and go “operational”. During the transit, the necessary publications and codes a are distributed. The radar operator plots, classifies, and annotates the surface contacts en route using radar.
2250	As the CP-140 approaches within 150 NM of the On Station point, the radar operator begins detecting and entering radar contacts that are inside the assigned patrol area.
2255	The radar operator begins classifying the closest surface contacts on radar according to their size, position and MLA. As each contact is classified, the contact file is annotated accordingly. The radar operator also checks for weather and other air traffic using radar and IFF/SIF between classifying contacts.
2305	The MC initiates the On Station Check a few minutes before the CP-140 reaches the On Station point. The MC also orders the crew to reduce internal and external illumination to maintain covertness. The copilot turns off all exterior lighting, and all windows are covered and that minimum lighting is used in the cabin. The radar operator continues classifying contacts on radar.

Table 2. *CP-140 FISHPAT Scenario – Chronological Sequence of Events*

TIME	EVENT
FISHERIES PATROL	
2310	The CP-140 crosses into the search area at the On Station point. The NAVCOM transmits the On Station message. During the transit across the assigned patrol area, voice communications are established with the DFO vessel Chebucto on the frequency provided at the pre-flight briefing. The current location of the DFO vessel is obtained along with a SITREP. In return, the CP-140 position and intentions are reported to the DFO vessel. The radar operator identifies the Chebucto on radar using the reported position and annotates the contact file accordingly. The TACNAV, in consultation with the DFO officer, quickly determine the order of contact investigation. The highest priority contacts are located where the Grand Banks extend beyond the 200 NM limit, about 25 NM beyond the On Station point.
2326	When the CP-140 has compiled a radar plot of the assigned patrol area, the pilot initiates a descent, reduces speed, and monitors the progress of the radar plot. Because this is a night mission, the DFO officer prepares to assist in identifying contacts and fishing activity on the EO display(s). The DFO officer occupies one of the passenger seats, or stands behind the EO/IR operator. The radar operator determines a vector to fly to the first group of contacts and reports it to the pilot. The first group consists of five fishing vessels within a three mile area. The radar operator uses the radar display to enter waypoints which will take the CPA through the group of contacts at identification range. The pilot descends the aircraft and reduces speed.
2338	The EO/IR operator slews the EO turret onto the first radar track symbol, selects the IR display and attempts to gain IR contact. The pilot reports seeing a faint glow of lights in the direction of the contacts at twenty miles range.
2340	The EO/IR operator detects the first vessel in the group, and announces that the IR detection range is 14 NM. The EO/IR operator initiates automatic EO tracking of the first contact, narrows the FOV slightly and begins recording the images. The EO/IR operator begins reporting vectors for the homing using the IR display. The EO/IR operator switches to the LLLTV (as the primary sensor) and narrows the FOV even further and searches for the licence number of the vessel. The pilot reports that the lights of the vessels are now visual, but directs the EO/IR operator to continue the IR homing.
2345	Twenty seconds back from the vessel, the DFO officer and the EO/IR operator, observing the EO/IR display, begin to note the fishing activity of the vessel and equipment being used. The EO/IR operator then begins to enter this information into the contact file. A few seconds later the EO/IR operator illuminates the contact with the laser illuminator, narrows the LLLTV FOV further, adjusts the LLLTV focus and introduces slight manual inputs to the EO automatic tracking so that the turret is directed at the expected location of the licence. As the CP-140 comes abeam the vessel, the EO/IR operator marks an index point and reads the licence aloud on ICS. This simultaneously informs all crew members that the licence has been identified, records the verbal report on the audio/video recorders, and allows another crewmember to enter it into the log. The licence number is entered into the contact file. The EO/IR operator slews the EO turret to the next closest contact. After correlating with the database, the computer places a “VALID” indicator in the contact file of the first vessel in the display buffer.
2346	The EO/IR operator initiates EO automatic tracking on the second vessel and illuminates the contact, locates the licence, and narrows the FOV. The EO/IR operator and the DFO officer observe the fishing activity and equipment on the IR display. The contact file is annotated with the information. A small manual adjustment to the aiming of the EO turret is made and the licence is read across ICS and entered. This vessel is also fishing, and has a valid licence.
2347	The EO/IR operator slews the EO turret to the third contact, checks the relative bearing and distance to the contact, and requests the pilot to make a slight heading correction to bring the aircraft closer it.

Table 2. *CP-140 FISHPAT Scenario – Chronological Sequence of Events*

TIME	EVENT
	The pilot turns slightly, and then lines up the CP-140 using the lights of the vessel as a reference. The crew identifies the third vessel and the information is entered into the contact file. The radar operator vectors the pilot back to the group on a heading which will allow the last two vessels to be identified.
2350	Using the same procedure, the crew identifies the last two vessels which also have valid licences.
2353	The radar operator observes a heavy weather cell, probably a snow shower, on radar and reports it. The weather is blocking the direct route to the next contact, and the radar operator provides a vector to avoid it. The pilot turns, and the EO/IR operator slews the turret to the next contact but is unable to detect anything in IR mode. During the initial descent into the area, the crew had originally classified the next two contacts by their size, MLA, and proximity to each other as two vessels pair trawling.
INVESTIGATE VIOLATOR	
2355	The CP-140 is past the snow shower, and the radar operator directs the pilot to turn in toward the pair trawlers. As the pilot levels the CP-40 on the new vector, the EO/IR operator detects the nearest contact on IR and initiates EO tracking of the contact. The EO/IR operator then calls contact and takes over the final stage of the homing. The EO/IR operator monitors the LLLTV, narrows the FOV and adjusts the EO turret slightly to find the licence number on the top of the superstructure.
2356	When the CP-140 is abeam the contact, the EO/IR operator locates the licence and marks an index point on the recording, but is unable to read all the characters before the roll of the vessel and the progress of the CP-140 take the licence markings out of the FOV. The EO/IR operator requests that the pilot continue on the current heading for a few more seconds so that the captured video may be replayed.
2357	The pilot maintains straight and level flight while the EO/IR operator reviews the captured video. The EO/IR operator freezes the video and advances it frame-by-frame until the licence is legible. The EO/IR operator reads the licence on ICS and enters it into the contact file. The radar operator uses the radar display to vector the pilot back toward the pair trawlers.
2358	The EO/IR operator slews the EO turret onto the next contact, but the computer indicates that the first contact of the pair is in violation. The MC orders a confirmation run of the first vessel, and the EO/IR operator reports the vector. The EO/IR operator monitors the IR image after slewing the EO turret to the radar track symbol of the first vessel. When the contact is detected, the EO/IR operator initiates automatic EO tracking and begins recording. The EO/IR operator also monitors LLLTV imagery in preparation for recording the licence number.
DOCUMENT VIOLATOR	
2359	On this pass, EO/IR operator selects an appropriate FOV to record the activity on deck, the fishing gear and the lines over the side, taking into account the requirement to record the licence of the vessel in LLLTV mode. The EO/IR operator introduces small inputs into the EO automatic tracking of the vessel to locate the licence number of the vessel again. The copilot notes and records the FMS navigation source in the Significant Event Log. As the CP-140 comes abeam, the EO/IR operator marks an index point, and confirms the licence number. The pilot manoeuvres to return to the second contact with the aid of radar vectors.
0001	By this time the vessels have noticed the presence of the CP-140 and are hauling in their net and attempting to evade. Despite this, the second vessel is identified and the AESOPs are able to record the licence and deck activity on the first attempt. The second vessel is also a violator.
REPORT VIOLATOR	
0002	The MC directs the crew to report the violator to the DFO vessel and to shore authorities. The pilot

Table 2. *CP-140 FISHPAT Scenario – Chronological Sequence of Events*

TIME	EVENT
	applies power, turns toward the DFO vessel, and climbs while the violation report is constructed. The pilot levels off and establishes the aircraft in a loiter orbit near the violators. The Chebucto is contacted and the positions, MLAs, licence numbers and observed fishing activity of the violators are reported to the DFO vessel. The Chebucto is located and vectored to intercept the violators. The violation report with amplifying imagery is transmitted to the TA through the military long-range communications facility on secure HF voice.
0005	The radar operator updates the surface plot and classifies the next twelve contacts while the first NAVCOM is communicating with the DFO vessel and shore authorities.
0010	After the Chebucto is established en route and the radar operator has classified and prioritized the contacts, the pilot requests vectors to the next contact and descends to 500' ASL at 190 KIAS.
EN ROUTE TO DESTINATION	
0155	The copilot selects the waypoint representing CFB Greenwood for steering on the FMS, and requests clearance from present position direct at 18,000'. The cooperating units are informed via secure voice that the CP-140 is preparing to return to base. The pilot continues to maintain a loiter profile while waiting for the clearance.
0205	The CP-140 is cleared to proceed "present position direct CFB Greenwood", and the copilot reads back the clearance. The pilot sets climb power and initiates a climb to 18,000'. The cooperating units are informed that the CP-140 is now departing the area and closes watch with the military communications facility.
0210	The pilot levels the aircraft at 18,000' and calls for the Off Station Check. The copilot initiates an ICS check, then reads the checklist items and each crew member responds in turn. The mission equipment is stowed.
APPROACH	
0220	The copilot is directed by Moncton Centre to contact the Shearwater approach controller. The copilot selects the frequency, establishes contact and requests approach clearance. The CP-140 is cleared to perform an IFR approach. The copilot reads back the clearance and both pilots turn to the appropriate approach plate. The EO/IR operator turns off the IR system, and then turns off IR cooling.
0225	The CP-140 is cleared to commence a descent to 8,000'. The copilot reads back the clearance and the pilot initiates the descent. The copilot totals the remaining fuel, and then calculates the aircraft weight and landing speed and informs the pilot. The pilot gives the approach brief. The copilot verifies the IAF is tuned and identified, and both pilots configure their I/FDIs for the approach.
0240	The pilot reduces speed and the CP-140 is cleared to continue descent further to 5000'.
0243	The CP-140 is cleared to the IAF, and the pilot turns slightly, adjusts the rate of descent and reduces speed to arrive over the IAF in the appropriate flight profile.
0245	The CP-140 crosses the IAF, and is cleared to continue the approach. The pilot sets the flaps, speed, heading and attitude for the published approach.
LAND	
0247	The pilot lowers the landing gear and the CP-140 is cleared to land.
0248	Just before the CP-140 crosses the threshold, the copilot calls the runway visual, and the pilot completes the landing visually. The pilot deploys the ground spoilers and thrust-reversers after

Table 2. CP-140 FISHPAT Scenario – Chronological Sequence of Events

TIME	EVENT
	touch-down. During the roll-out, WOPs is informed that the aircraft has landed. The copilot obtains taxi clearance back to the ramp.
POST FIGHT TAXI	
0250	The pilot taxis to the ramp using nosewheel steering, on the route cleared by ATC. On the ramp, the pilot follows the marshaller's directions into the parking spot. After the aircraft is stopped, the pilot sets the parking brake, and, after ground power is available, the engines are shut down.
SHUTDOWN AND DEBRIEF	
0250	The pilot calls for the Shut Down Check. The copilot reads the checklist and each crew member responds in turn. The mission systems are turned off first, then the central computer. The software media from the central computer is removed and placed it in the publications bag. The crew members retrieve their personnel equipment, publications and mission equipment and exit the aircraft.
0305	The crew members return the publications, codes and mission equipment. The CP-140 crew and OGD personnel are debriefed by WOPs personnel, and the post-flight report is filed. When all mission documentation is completed and handed over to WOPs, the crew is released.

A.2.3 Scenario 3: Surveillance of Targets and OTHT.

This scenario involves the launch of a CP-140 aircraft to detect, classify, and identify a surface threat within a littoral environment (over water and overland). Upon classifying the contact, the CP-140 will provide targeting coordinates to enable over-the-horizon targeting by a friendly firing unit. This type of mission can be conducted at any time of the day or night, in all weather conditions, in any area in Canada, and may occur on any day of the year.

Situation

A Canadian Task Group (CTG) has been tasked to assist a friendly nation due to increasing hostilities with a small rogue nation to the North. To that end, the CTG with aid from the Arleigh Burke (DDG-51) are escorting two Joint Supply Ships (JSS) with troops in order to launch a land-based attack on the rogue nation headquarters. The rogue nation possesses a small surface fleet, potent submarine force, as well as land-based assets. Tension between the north nation and the southern friendly nation has increased in response to disputes over oil rights. The rogue nation has caused disruption to commercial shipping and it is believed that they have sunk ships in the past. Previous intelligence indicates that the hostile nation may use their submarines to strike at the CTG to weaken the alliance's resolve.

The CTG is about 300 nm from the entrance to the straits and at 0800 Zulu begins escorting the JSS towards the narrow straits using a sector screen. Two Maritime Helicopters (MHs) are continuously on task in a sub-surface area search ahead of the CTG. Their tasking is to conduct a sector search ahead of the TG using TSSS as the primary sensor. The primary subsurface threat is a Surface-to-Surface (SSM)-fitted diesel-electric submarine. Intelligence indicates there may also be a nuclear submarine in transit from the North. The MH is operating with a full load of sonobuoys and two torpedoes. The current Rules of Engagement (ROE) do not authorize attacks unless there is a Hostile Act. All subsurface contacts in the vicinity of the CTG are to be positively identified and requested to surface. In addition, the MHs are tasked to maintain the Recognized Maritime Picture (RMP) ahead of the force to safeguard against any potential surface approach to the CTG. One additional CTG helicopter is kept on Alert 30 (30 minutes-to-launch stand-by posture) for 24 and 7 (24 hrs per day, 7 days per week).

The advance of the CTG is constrained by the speed of the JSS which are traveling at 15 knots due to sea state and environmental conditions.

A friendly submarine is located in the vicinity of the task force to provide assistance against a potential engagement by the threat.

Imagery from a HALE UAV employed by the friendly forces indicates that four OSA class patrol boats, a conventional submarine, and a nuclear submarine from the northern nation are no longer in harbour. To classify and identify the surface contacts, a CP-140 is to be deployed from a base located on the south shore of the friendly state. Previous UAV strip mapping has also provided data regarding positions of SAM and SSM missile batteries along the east coast of the rogue nation.

Chronological Sequence of Events

Table 3. *CP-140 OTHT Scenario – Chronological Sequence of Events*

TIME	EVENT
TRANSIT TO CTG	
1200	The CP-140 is airborne from a base located on the southern region of friendly state and heading northeast towards the CTG at 23 000 ft ASL and 350 Knots True Air Speed (TAS).
1300	During the short transit the NAVCOM constructs a joining message. The TACNAV assists the NAVCOM by setting up the datalink. NASO-1 looks up the IFF squawks appropriate to the CTG, and NASO-2 modifies the ESM scan bands applicable to the units in the CTG. The TACNAV reminds the crew of the briefed mission and the NAVCOM enters a position of the joining corridor. The TACNAV has the radar operator search for the force. NASO-1 identifies and enters several radar contacts and interrogates them in an attempt to establish their identity. Two of the contacts respond correctly to the IFF/SIF, and the ESM operator identifies a few signals from the area of the force correlating to known friendly emitters. The NAVCOM conducts an hourly system check.
JOIN CTG AND RECEIVE TASKING	
1330	The NAVCOM contacts the CTG on UHF, identifies the aircraft to the force, and then transmits the join message on secure voice.
1340	The aircraft has been identified by the force and is cleared to proceed. During the short transit, the sensor operators gather information about the friendly and enemy forces and the TACNAV evaluates the information shown on the tactical display. The NAVCOM establishes datalink communications with the friendly force and then has the force assume flight guard for the aircraft. The NAVCOM transmits a message to HQ indicating that the aircraft has successfully joined the CTG.
1345	The NAVCOM receives a new tasking message from the OTC. The crew has been tasked with the following: a. Primary mission – conduct surface surveillance (land and water) of a given search area (with due consideration to the enemy state's 12nm territorial limit), locate and report all surface contacts, identify targets of primary interest - 4 Osa Fast Patrol Boats (FPBs), b. Secondary mission – once Osas are located and identified, verify missile batteries remain in position; maintain tracking and reporting on Osa (primary threat), c. Tertiary mission – deploy sonobuoy barrier (passive, 8 hr life) near northern boundary of patrol area; report but do not investigate acoustic or disappearing radar contacts (location of threat submarine unknown). The crew determines whether the tasking is feasible based on the serviceability of the aircraft and

Table 3. CP-140 OTHT Scenario – Chronological Sequence of Events

TIME	EVENT
	mission systems and PLE. The tasking is considered feasible. The NAVCOM advises the tasking authority of the ETA to the patrol area and the estimated endurance available for route surveillance. The pilot transits toward the patrol area.
1355	As the crew transits to the patrol area, the TACNAV briefs the crew. The crew considers the dispositions of the friendly and enemy forces, the radar coverage of the aircraft, and the stand-off range in determining a precise observation position and flight pattern. The radar is set to wide area surveillance mode as a means to detect and perform a high-level classification of contacts.
1405	During the transit, the crew observes the local weather conditions and updates the sensor ranges. The TACNAV considers the impact of the new sensor ranges on the conduct of the mission. The TACNAV determines the optimal search pattern.
SURVEILLANCE OF PATROL AREA (OVER WATER)	
1415	As the crew arrives on station, the pilot keeps the aircraft at a search altitude of 20 000 feet ASL to patrol the 100x150 nm area. The NAVCOM transmits the ‘On Station’ report. The radar operator begins to conduct a surface plot of the assigned patrol area and the NAVCOM transmits the contact information on data-link to the CTG. This allows the crew to search for surface contacts while occasionally moving into the coastline to assess the land threat (i.e. missile batteries). The crew determines the order in which the radar contacts are to be investigated, assigning a higher priority to the contacts potentially resembling the COI (i.e. Osa).
1430	The crew continues along the search pattern to conduct surveillance of the patrol area. The aircraft remains at 20 000 feet ASL as no radar contacts resemble the threat. In areas of low surface ship density, when the aircraft is near the coastline, the radar operator periodically switches the radar to Ground Moving Target Indicator (GMTI) or LandSpot mode to investigate the land-based threat (i.e. fixed and mobile missile systems) while remaining outside territorial waters and with due consideration to weapons stand-off range.
1530	The radar operator alerts the crew that two contacts near the center of the area (50 nm off-shore) fit the OSA classification. The TACNAV orders the pilot to descend the aircraft to support classification and identification of the contacts.
1532	The pilot begins to descend and steers toward the first contact using the bearing and range information passed on the ICS by the radar operator. The radar operator also watches for obstructions during the descent (e.g. other aircraft). The aircraft is leveled at an altitude (5 000 to 10 000 feet ASL) that allows for good horizontal visibility and employment of the EO/IR sensors to further identify the contacts as OSAs, with due regard to weapon stand-off ranges.
1542	On the run in toward the first contact, the IR is trained in the direction of the contact as indicated by radar. As the vessel comes into view, the lookouts and IR operator try to identify the vessel type. The IR gains contact and the IR operator continues the homing until the pilot gains visual contact or until identification is accomplished with the EO system.
1555	With two contacts identified by the aircrew, the radar search continues and the TACNAV selects a search pattern that will allow the remaining two targets to be localized while maintaining track on the two known OSAs.
1605	Two targets are detected close to shore, classified by Seaspot as OSA type. Targets are transiting to an intercept point that is along the CTG’s MLA. Identification is attempted while remaining outside territorial waters and with due regard to shore based and OSA based weapon stand off ranges.
1630	At the northern boundary of the search pattern, the TACNAV selects and deploys a passive sonobuoy pattern in an attempt to detect the conventional submarine. To that end, the pattern establishes a northern barrier to alert the CTG against sub-surface threats.

Table 3. *CP-140 OTHT Scenario – Chronological Sequence of Events*

TIME	EVENT
1715	With four OSA contacts classified/ identified by the aircrew, the TACNAV selects a flight pattern that allows the crew to continue: a. conducting surveillance of the COIs; b. generating the picture of the land based threat; c. generating the RMP; and d. monitoring the acoustic barrier.
1845	CP-140 proceeds to off task point and SWAPs with relief who has previously joined the force. Tasking unchanged.
1900	The CTG is approximately 135 nm from the entrance to the straits.
OVER THE HORIZON TARGETING (OVER WATER)	
1915	The four OSAs (two coming down the coast and the two seaward) remain on course to converge with the CTG in the harbour and are therefore deemed a threat by the OTC
1918	The NAVCOM receives a tasking message from the OTC. After decoding the message the NAVCOM briefs the crew on its contents. The crew has been tasked to conduct over-the-horizon-targeting against the seaward Osas. The current observation position and orbiting flight path are deemed sufficient to allow the radar operator to monitor the firing units and targets simultaneously as much as possible.
1925	The ASuWC assigns targets to the firing units, designates the missile arrival times for the targets and allocates the number of missiles to be fired at each target. The NAVCOM receives the information and notes which friendly ships will be firing on which targets. It is up to the firing units to determine the appropriate missile launch times. Acoustics continue to monitor the sonobuoy barrier for possible SSK activity.
1930	The NAVCOM starts passing the ranges and bearings between firing units and their targets. A number of fishing boats are in the vicinity of the OSAs, thereby complicating the targeting solution.
1935	The radar operator and NAVCOM continue to work together to provide targeting to the firing units and the TACNAV monitors the radar coverage and the progress of the OTHT mission.
1945	The OTC orders the attack and missiles are launched for simultaneous arrival on target. The NAVCOM monitors the reporting net.
BATTLE DAMAGE ASSESSMENT (OVER WATER)	
1955	The NAVCOM receives a secure voice message directing the crew to conduct damage assessment of the enemy force. The radar operator images the targets using SeaSpot and determines the OSAs are still afloat but apparently damaged.
2000	After considering the enemy sensors and weapons and the available aircraft sensors, the TACNAV formulates a plan and briefs the crew. A RADAR/EO handover is executed and all active transmissions are ceased.
2005	The pilot initiates a descent.

Table 3. *CP-140 OTHT Scenario – Chronological Sequence of Events*

TIME	EVENT
2010	The TACNAV chooses an approach gambit, electing to approach the enemy force from a different direction than the targeting was being conducted from. The pilot levels the aircraft at minimum altitude to minimize counter detection. All the lookout positions are manned and the crewmembers alerted as the aircraft approaches the enemy force.
2015	At an estimated range of fifteen miles from the enemy force, the MPC climbs to 1000' and the radar is switched on. The ESM system reports no threat radars and NASO-2 is searching a narrow sector ahead with the EO system, recording everything on the VCR. The Copilot and FE look ahead, the Copilot using binoculars to look for indications of damage. The MPC immediately initiates a descending turn to an appropriate altitude for employment of the EO sensor.
2025	The TACNAV takes the reports from all the sensors and attempts to build a coherent picture. There is one fewer radar contact than before, and the Flight Deck and EO operator report seeing a column of black smoke from a target classified as OSA.
2030	The pilot brings the speed back to normal cruise, climbs to the original search altitude and departs to the South. The NAVCOM transmits the damage report and the TACNAV and radar operator update the surface plot, searching for the remaining OSAs.
2035	The radar operator reports the remaining OSA is moving slowly to the NorthEast, and contact is regained on the remaining two OSAs close to the shoreline. The aircraft is tasked by the OTC to continue maintaining surveillance on the threat.
2037	The TACNAV orders the pilot to climb to an altitude to maintain a safe observation position.
2040	OSAs are no longer deemed a threat. CP-140 proceeds to off-task point and SWAPs with relief who has previously joined with Task Force. New CP-140 is tasked by the OTC to conduct overland surveillance of missile batteries.
SURVEILLANCE OF LAND TARGETS	
2100	As the crew transits to the patrol area, the TACNAV briefs the crew. The crew considers the radar coverage of the aircraft, and the stand-off range in determining a precise observation position and flight pattern. The radar switches the radar to GMTI or LandSpot mode to investigate the land-based threat (i.e. fixed and mobile missile systems).
2110	During the transit, the crew observes the local weather conditions and updates the sensor ranges. The TACNAV considers the impact of the new sensor ranges on the conduct of the mission. The TACNAV determines the optimal search pattern.
2130	As the crew arrives on station, the pilot keeps the aircraft at a search altitude of 10 000 feet ASL to patrol the coastline. The radar operator begins to conduct a surface plot of the assigned patrol area and the NAVCOM transmits the contact information on data-link to the CTG. The TACNAV determines the order in which the radar contacts are to be investigated, assigning a higher priority to the contacts potentially resembling the missile batteries.
2145	The crew continues along the search pattern to conduct surveillance of the patrol area. The aircraft remains at 10 000 feet ASL as no radar contacts resemble the threat.
2200	The radar operator alerts the crew that a contact fits the missile-battery classification. The TACNAV orders the pilot to descend the aircraft to support classification and identification of the contacts.
2210	The pilot begins to descend and steers toward the contact using the bearing and range information passed on the ICS by the radar operator. The radar operator also watches for obstructions during the descent. The aircraft is evelled at an altitude (5 000 to 10 000 feet ASL) that allows for good horizontal visibility and employment of the EO/IR sensors to further identify the contact as a missile

Table 3. *CP-140 OTHT Scenario – Chronological Sequence of Events*

TIME	EVENT
	battery, with due regard to weapon stand-off ranges.
2220	On the run in toward the contact, the IR is trained in the direction of the contact as indicated by radar. As the battery comes into view, the lookouts and IR operator try to identify the type. The IR gains contact and the IR operator continues the homing until the pilot gains visual contact or until identification is accomplished with the EO system.
2225	With the contact identified by the aircraft crew, the TACNAV selects a search pattern that will allow other missile batteries to be localized while maintaining surveillance of the most southern missile battery.
2245	The TACNAV selects a flight pattern that allows the crew to continue conducting surveillance of the COIs; generating the picture of the land based threat; and generating the RMP.
2300	The CTG are approximately 80 nm from the entrance to the straits.
PROVIDE OVER-THE-HORIZON TARGETING (OVERLAND)	
2305	Given the approach to the straits which brings the CTG in ‘close’ proximity of the land-based missile batteries, they are deemed a threat by the OTC
2310	The NAVCOM receives a tasking message from the OTC. After decoding the message the NAVCOM briefs the crew on its contents. The crew has been tasked to conduct over-the-horizon-targeting against the missile batteries. The current observation position and orbiting flight path are deemed sufficient to allow the radar operator to monitor the firing units and targets simultaneously as much as possible.
2315	The AsuWC assigns targets to the firing units, designates the missile arrival times for the targets and allocates the number of missiles to be fired at the target. The NAVCOM receives the information and notes the DDG-51 will be firing on the designated target. It is up to the firing units to determine the appropriate missile launch times.
2320	The NAVCOM starts passing the ranges and bearings between firing units and their targets.
2325	The radar operator and NAVCOM continue to work together to provide targeting to the firing units and the TACNAV monitors the radar coverage and the progress of the OTHT mission.
2335	The OTC orders the attack and missiles are launched for simultaneous arrival on target. The NAVCOM monitors the reporting net.
CONDUCT DAMAGE ASSESSMENT (OVERLAND)	
2345	The NAVCOM receives a secure voice message directing the crew to conduct damage assessment of the enemy force. The radar images the targets using LandSpot and determines the missile battery is damaged.
2350	After considering the enemy sensors and weapons and the available aircraft sensors, the TACNAV formulates a plan and briefs the crew.
2355	The pilot initiates a descent.
0000	The TACNAV chooses an approach gambit, electing to approach the enemy force from a different direction than the targeting was being conducted from. The pilot levels the aircraft at minimum altitude to minimize counter detection. All the lookout positions are manned and the crewmembers alerted as the aircraft approaches the enemy force.

Table 3. *CP-140 OTHT Scenario – Chronological Sequence of Events*

TIME	EVENT
0005	At an estimated range of fifteen miles from the enemy force, the MPC climbs to a safe altitude and the radar is switched on. The ESM system reports no threat radars and NASO-2 is searching a narrow sector ahead with the EO system, recording everything. The Copilot and FE look ahead, the Copilot using binoculars to look for indications of damage. The MPC immediately initiates a descending turn to an appropriate altitude for employment of the EO sensor.
0015	The TACNAV takes the reports from all the sensors and attempts to build a coherent picture. There is one less radar contact than before, and the Flight Deck and EO operator report seeing a column of black smoke from the missile battery location.
0020	The pilot brings the speed back to normal cruise, climbs to the original search altitude and departs to the South. The NAVCOM transmits the damage report and the TACNAV and the radar operator update the surface plot, searching for the other missile batteries.
0030	The CP-140 continues to provide OTHT support to the CTG for the remaining missile batteries that are considered a threat to the CTG. The CP-140 continues to support the tasking until either the mission is complete or the PLE is reached at which point the CP-140 proceeds to off-task point and SWAPs with relief who has previously joined with Task Force.

Annex B Inventory of Functions

B.1 FWSAR Inventory of Functions

The hierarchical inventory of FWSAR functions was limited to those that are pertinent to the subsequent analysis of the AIMS tasks. As such, a comprehensive list of all functions for each individual top-level function is not provided. First-level functions that do not include interactions with the AIMS system were not decomposed to a lower level. See Reference 6 for a complete list of functions for the FWSAR aircraft.

1 Pre-Flight

- 1.1 Report for Duty
- 1.2 Pre-Flight Aircraft
  - 1.2.1 Exterior Safety Inspection
  - 1.2.2 Aircraft External Inspection
  - 1.2.3 Cockpit Safety Inspection
  - 1.2.4 Cabin Safety Inspection
  - 1.2.5 SAR Equipment Inspection
- 1.3 Receive SAR Tasking
- 1.4 Receive SAR Transport Tasking
- 1.5 Receive Aeromedical Tasking
- 1.6 Flight Planning
- 1.7 Transit to Aircraft

2 Pre-Start and Start

- 2.1 Pre-Start Preparation
- 2.2 Conduct Normal Start
- 2.3 Complete After-Start Checklist
- 2.4 Conduct Routine Communications
- 2.5 Monitor and Manage Aircraft Systems

3 Pre-Flight Taxi

- 3.1 Obtain IFR Clearance
- 3.2 Update Flight Log
- 3.3 Taxi Aircraft to Runway
- 3.4 Conduct Before Takeoff Check
- 3.5 Conduct Routine Communications
- 3.6 Monitor and Manage Aircraft Systems

4 Takeoff and Initial Climb

- 4.1 Position Aircraft On Runway

4.2 Conduct Takeoff
4.3 Conduct Departure
4.4 Conduct Routine Communications
4.5 Monitor and Manage Aircraft Systems

5 Reject Takeoff

5.1 Position Aircraft on Runway
5.2 Initiate Takeoff Roll
5.3 Reject Takeoff Prior to V1
5.4 Taxi Clear of Runway
5.5 Conduct Routine Communications
5.6 Monitor and Manage Aircraft Systems

6 Climb

6.1 Conduct Climb
6.2 Perform Climb Flow Checks
6.3 Level Off at Cruise Altitude
6.4 Update Flight Log
6.5 Conduct Routine Communications
6.6 Monitor and Manage Aircraft Systems

7 En Route

7.1 Control Aircraft
7.2 Update Flight Log
7.3 Prepare for Descent to Search Area
7.4 Conduct Routine Communications
7.5 Monitor and Manage Systems

8 Search And Rescue

8.1 Receive SAR Tasking
- 8.1.1 Receive SAR Tasking Request
- 8.1.2 Determine Tasking Feasibility
- 8.1.3 Respond to Tasking

8.2 Transit to SAR Area
- 8.2.1 Enroute Flight To SAR Area
- 8.2.2 Communicate With Controlling Agency
- 8.2.3 Prepare Search Plan
- 8.2.4 Brief Crew
- 8.2.5 Prepare Search Sensors and Equipment
- 8.2.6 Perform Traffic/Weather/Terrain Avoidance

8.3 Conduct Search
- 8.3.1 Approach Search Area
- 8.3.2 Compile Radar Plot

- 8.3.3 Conduct Electronic Search
- 8.3.4 Detect and Localize ELT/PLB
- 8.3.5 Descend and Conduct Search Using Onboard Sensors
- 8.3.6 Conduct Visual Search
- 8.3.7 Perform Traffic/Weather/Terrain Avoidance

8.4 Locate Object of Search

- 8.4.1 Detect Search Contact
- 8.4.2 Home and Identify Search Contact
- 8.4.3 Return to Search pattern
- 8.4.4 Perform Traffic/Weather/Terrain Avoidance

8.5 Coordinate Local Assets

8.6 Vector Local Assets to Object

- 8.6.1 Establish Local Assets Inbound to Search Object
- 8.6.2 Vector Local Assets to Object
- 8.6.3 Monitor and Report Progress of Rescue
- 8.6.4 Perform Traffic/Weather/Terrain Avoidance

8.7 Effect Rescue

- 8.7.1 Conduct Recce
- 8.7.2 Brief Rescue Plan
- 8.7.3 Perform Traffic/Weather/Terrain Avoidance
- 8.7.4 Perform Equipment Drop
- 8.7.5 Perform Personnel Drop
- 8.7.6 Loiter in Vicinity

8.8 Climb to Altitude

8.9 Conduct Routine Communications

8.10 Monitor and Manage Aircraft Systems

9 En Route to Destination

9.1 Control Aircraft

9.2 Update Flight Log

9.3 Prepare for Descent and Arrival

9.4 Conduct Routine Communications

9.5 Monitor and Manage Aircraft Systems

10 SAR Transport Mission (En Route)

10.1 Control Aircraft

10.2 Update Flight Log

10.3 Prepare for Descent and Arrival

10.4 Conduct Routine Communications

10.5 Monitor and Manage Aircraft Systems

10.6 Monitor Cargo and/or Passengers

11 Aeromedical Evacuation (En Route)

11.1 Control Aircraft

11.2 Update Flight Log

11.3 Prepare for Descent and Arrival

11.4 Conduct Routine Communications

11.5 Monitor and Manage Aircraft Systems

11.6 Monitor Medical Team and Patients

12 Descent

12.1 Commence Descent

12.2 Conduct Hold

12.3 Maintain Descent

12.4 Complete Level Off

12.5 Complete Descent Flow Check

12.6 Complete Descent and Approach Check

12.7 Conduct Routine Communications

12.8 Monitor and Manage Aircraft Systems

13 Approach Transition

13.1 Control Aircraft

13.2 Conduct Hold

13.3 Plan Approach

13.4 Complete Descent and Approach Check

13.5 Conduct Routine Communications

13.6 Monitor and Manage Aircraft Systems

14 Approach

14.1 Obtain Approach Clearance

14.2 Conduct Precision Approach

14.3 Conduct Non-Precision Approach

14.4 Control Aircraft Configuration

14.5 Conduct Routine Communications

14.6 Monitor and Manage Aircraft Systems

14.7 Obtain Landing Clearance

15 Missed Approach/Rejected Landing

15.1 Conduct Go Around

15.2 Fly Missed Approach

15.3 Control Aircraft Configuration

15.4 Obtain Further Clearance

15.5 Conduct Routine Communications

15.6 Monitor and Manage Aircraft Systems

16 Land

16.1 Visually Acquire Runway
16.2 Control Aircraft
16.3 Land
16.4 Clear Runway
16.5 Obtain Taxi Clearance
16.6 Conduct Routine Communications
16.7 Monitor and Manage Aircraft Systems

17 Post Flight Taxi

17.1 Taxi to Parking Position
17.2 Complete After Landing Scan
17.3 Park
17.4 Conduct Routine Communications
17.5 Monitor and Manage Aircraft Systems

18 Shutdown and Debrief

18.1 Complete Pre-Shutdown Activities
18.2 Shutdown
18.3 Conduct Routine Communications
18.4 Monitor and Manage Aircraft Systems
18.5 Conduct Debrief
18.6 Unload Aircraft

B.2 CP-140 Inventory of Functions

Similar to the FWSAR, the hierarchical inventory of CP-140 functions was limited to those that are pertinent to the subsequent analysis of the AIMS tasks. As such, a comprehensive list of all functions for each individual top-level function is not provided. First-level functions that do not include interactions with the AIMS system were not decomposed to a lower level.

1 Pre-Flight
- 1.1 Report for Duty
- 1.2 Pre-Flight Aircraft
  - 1.2.1 Exterior Safety Inspection
  - 1.2.2 Aircraft External Inspection
  - 1.2.3 Cockpit Safety Inspection
  - 1.2.4 Cabin Safety Inspection
  - 1.2.5 Sensor Equipment Inspection
- 1.3 Receive Mission Tasking
- 1.4 Flight Planning
- 1.5 Transit to Aircraft

2 Pre-Start and Start
- 2.1 Pre-Start Preparation
- 2.2 Conduct Normal Start
- 2.3 Complete After-Start Checklist
- 2.4 Conduct Routine Communications
- 2.5 Monitor and Manage Aircraft Systems

3 Pre-Flight Taxi
- 3.1 Obtain IFR Clearance
- 3.2 Update Flight Log
- 3.3 Taxi Aircraft to Runway
- 3.4 Conduct Before Takeoff Check
- 3.5 Conduct Routine Communications
- 3.6 Monitor and Manage Aircraft Systems

4 Takeoff and Initial Climb
- 4.1 Position Aircraft On Runway
- 4.2 Conduct Takeoff
- 4.3 Conduct Departure
- 4.4 Conduct Routine Communications
- 4.5 Monitor and Manage Aircraft Systems

5 Reject Takeoff

5.1 Position Aircraft on Runway

5.2 Initiate Takeoff Roll

5.3 Reject Takeoff Prior to V1

5.4 Taxi Clear of Runway

5.5 Conduct Routine Communications

5.6 Monitor and Manage Aircraft Systems

6 Climb

6.1 Conduct Climb

6.2 Perform Climb Flow Checks

6.3 Level Off at Cruise Altitude

6.4 Update Flight Log

6.5 Conduct Routine Communications

6.6 Monitor and Manage Aircraft Systems

7 En Route

7.1 Control Aircraft

7.2 Update Flight Log

7.3 Prepare for Descent to Search Area

7.4 Conduct Routine Communications

7.5 Monitor and Manage Systems

8 Over Water Missions

8.1 Search And Rescue

8.1.1 Receive SAR Tasking

8.1.2 Transit to SAR Area

8.1.3 Conduct Search

8.1.4 Locate Object of Search

8.1.5 Coordinate Local Assets

8.1.6 Vector Local Assets to Object

8.1.7 Effect Rescue

8.1.8 Loiter in Vicinity

8.1.9 Climb to Altitude

8.2 Fisheries Patrol

8.2.1 Compile Surface Plot and Descend

8.2.2 Investigate Contact

8.2.3 Document and Report Violator

8.2.4 Update Surface Plot

8.2.5 Maintain Communications

8.2.6 Monitor and Manage Aircraft Systems

8.3 Pollution Investigation

8.3.1 Detect Pollution

8.3.2 Document and Report Pollution

8.3.3 Maintain Communications

8.3.4 Monitor and Manage Aircraft Systems

8.4 Contraband Interdiction

8.4.1 Receive Tasking to Intercept Aircraft

8.4.2 Transit on Vectors

8.4.3 Intercept and Identify Suspect Aircraft

8.4.4 Establish Covert Monitoring

8.4.5 Pursue Aircraft

8.4.6 Perform Handover

8.4.7 Monitor Landing Site

8.4.8 Direct Other Assets

8.4.9 Receive Tasking to Locate Other Vessel

8.4.10 Transit to Search Area and Compile Surface Plot

8.4.11 Descend into Search Area

8.4.12 Investigate Surface Contact

8.4.13 Establish Covert Surveillance

8.4.14 Coordinate Pursuit of Vessel

8.4.15 Maintain Communications

8.4.16 Monitor and Manage Aircraft Systems

8.5 Environmental Patrols

8.5.1 Descend into Search Area

8.5.2 Investigate Contact

8.5.3 Report Hazard

8.5.4 Update Surface Plot

8.5.5 Fly Patrol Route and Compile Radar Plot

8.5.6 Maintain Communications

8.5.7 Monitor and Manage Systems

8.6 Anti-Surface Warfare

8.7 Anti-Submarine Warfare

9 En Route to Destination

9.1 Control Aircraft

9.2 Update Flight Log

9.3 Prepare for Descent and Arrival

9.4 Conduct Routine Communications

9.5 Monitor and Manage Aircraft Systems

10 Overland Missions

10.1 Search and Rescue (same as 8.1)

10.2 Sovereignty Patrol

10.2.1 Descend and Assess Local Conditions

10.2.2 Transit to WP or COI

10.2.3 Locate Point of Interest

10.2.4 Conduct Sensor Search for COI

10.2.5 Detect COI

10.2.6 Descend to Investigation Altitude

10.2.7 Record Contact or Point of Interest

10.2.8 Climb to Search Altitude and Return to Track

10.2.9 Conduct Routine Communications

10.2.10 Monitor and Manage Aircraft Systems

10.3 Convoy Escort

10.3.1 Fly Patrol Route and Compile Radar Plot

10.3.2 Descend into Search Area

10.3.3 Investigate Contact

10.3.4 Establish Covert Monitoring

10.3.5 Update Surface Plot

10.3.6 Conduct Routine Communications

10.3.7 Monitor and Manage Aircraft Systems

10.4 Area/Point/Route Surveillance

10.5 Over-the-Horizon Targeting

10.5.1 Transit, Join Force and Receive Tasking

10.5.2 Compile and Report Surface Plot

10.5.3 Receive OTHT Tasking

10.5.4 Perform OTHT Reporting

10.5.5 Monitor Attack Phase

10.5.6 Conduct Battle Damage Assessment

10.5.7 Conduct Routine Communications

10.5.8 Monitor and Manage Aircraft Systems

10.6 Forward Air Controller

10.7 Communications Support/Relay

10.8 Pattern of Life Monitoring

10.9 Intelligence Collection

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12 Descent

12.1 Commence Descent

12.2 Conduct Hold

12.3 Maintain Descent

12.4 Complete Level Off

12.5 Complete Descent Flow Check

12.6 Complete Descent and Approach Check
12.7 Conduct Routine Communications
12.8 Monitor and Manage Aircraft Systems

13 Approach

13.1 Obtain Approach Clearance
13.2 Conduct Precision Approach
13.3 Conduct Non-Precision Approach
13.4 Control Aircraft Configuration
13.5 Conduct Routine Communications
13.6 Monitor and Manage Aircraft Systems
13.7 Obtain Landing Clearance

14 Approach Transition

14.1 Control Aircraft
14.2 Conduct Hold
14.3 Plan Approach
14.4 Complete Descent and Approach Check
14.5 Conduct Routine Communications
14.6 Monitor and Manage Aircraft Systems

15 Land

15.1 Visually Acquire Runway
15.2 Control Aircraft
15.3 Land
15.4 Clear Runway
15.5 Obtain Taxi Clearance
15.6 Conduct Routine Communications
15.7 Monitor and Manage Aircraft Systems

16 Missed Approach/Rejected Landing

16.1 Conduct Go Around
16.2 Fly Missed Approach
16.3 Control Aircraft Configuration
16.4 Obtain Further Clearance
16.5 Conduct Routine Communications
16.6 Monitor and Manage Aircraft Systems

17 Post Flight Taxi

17.1 Taxi to Parking Position
17.2 Complete After Landing Scan
17.3 Park
17.4 Conduct Routine Communications
17.5 Monitor and Manage Aircraft Systems

18 Shutdown and Debrief

18.1 Complete Pre-Shutdown Activities

18.2 Shutdown

18.3 Conduct Routine Communications

18.4 Monitor and Manage Aircraft Systems

18.5 Conduct Debrief

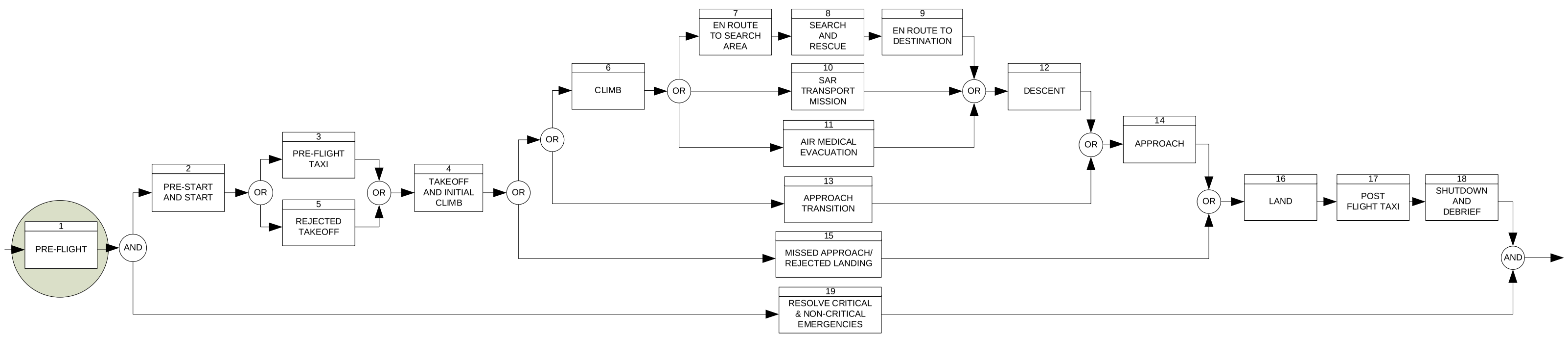
18.6 Unload Aircraft

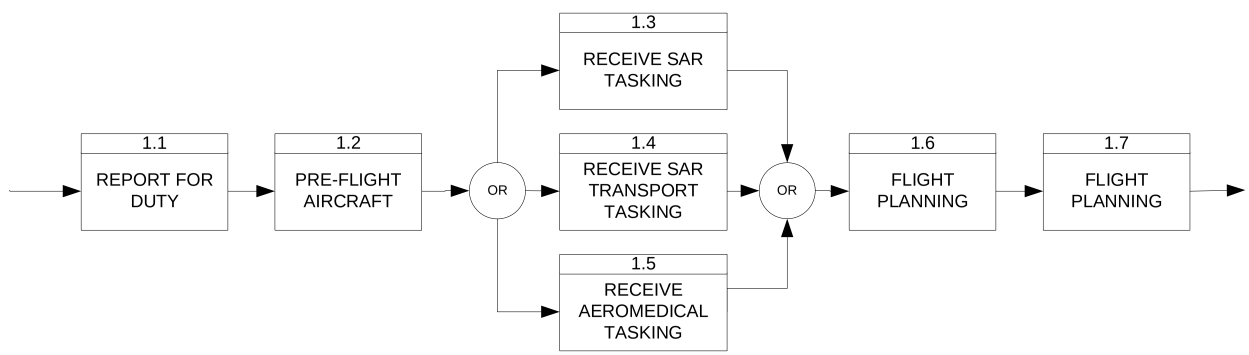
19 Resolve Critical & Non-Critical Emergencies

Annex C Function Flow Diagrams

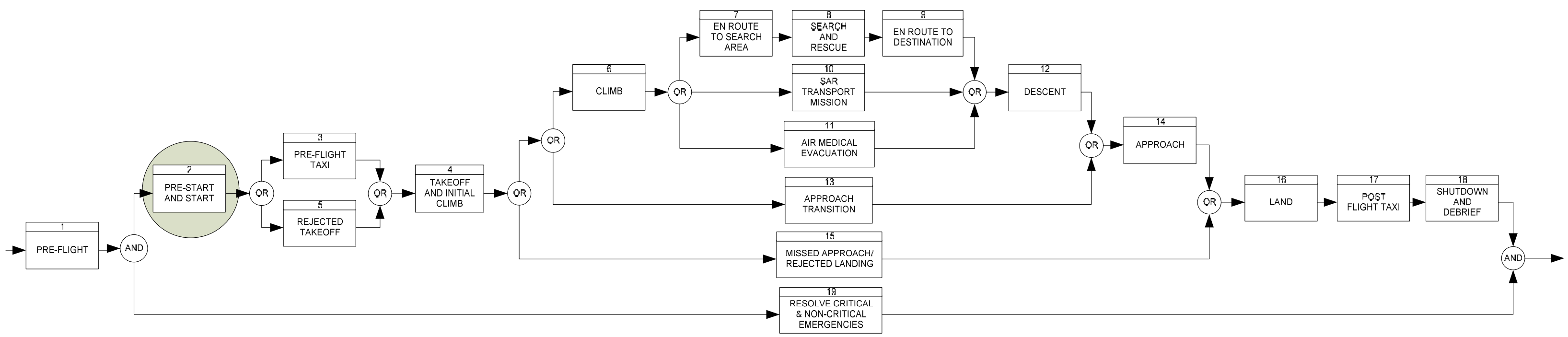
C.1 FWSAR Function Flow Diagrams

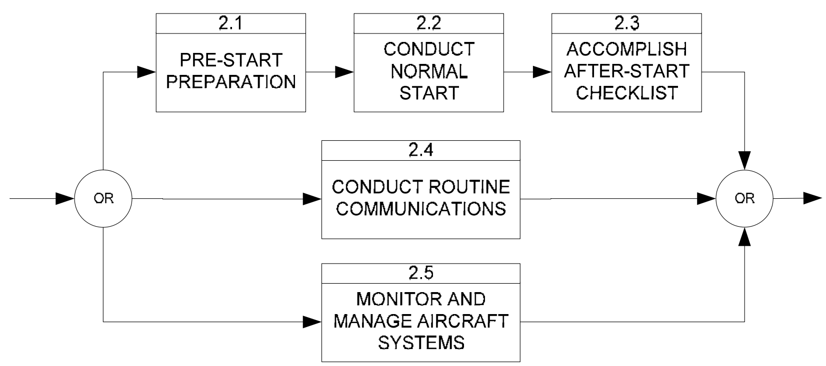
The FFDs for the FWSAR aircraft represent the top- and first-level functions [Reference 6]. FFDs for lower-level functions were limited to those segments whereby the AIMS system will play a significant role in the conduct of a mission.



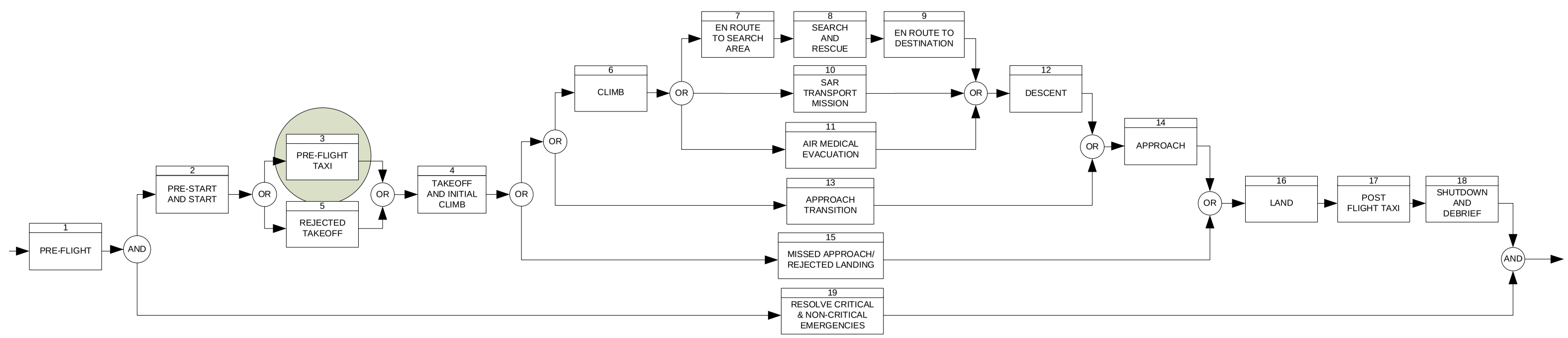


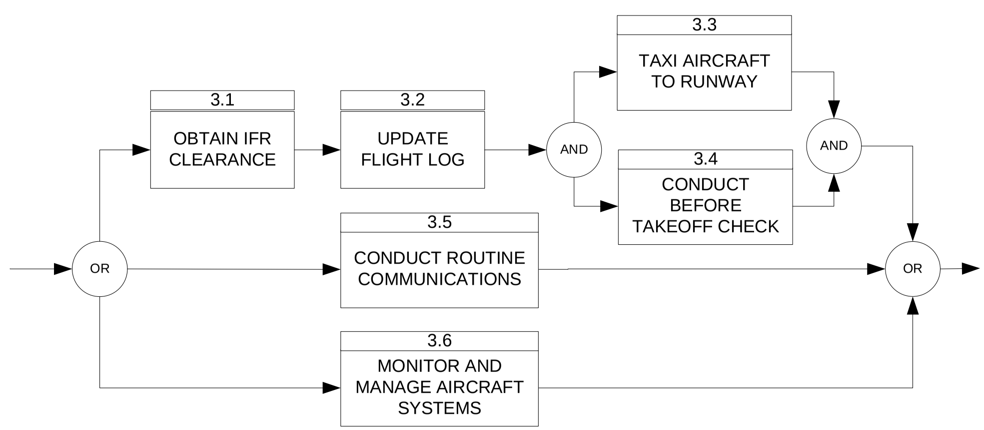
SEGMENT 1 – Pre-Flight



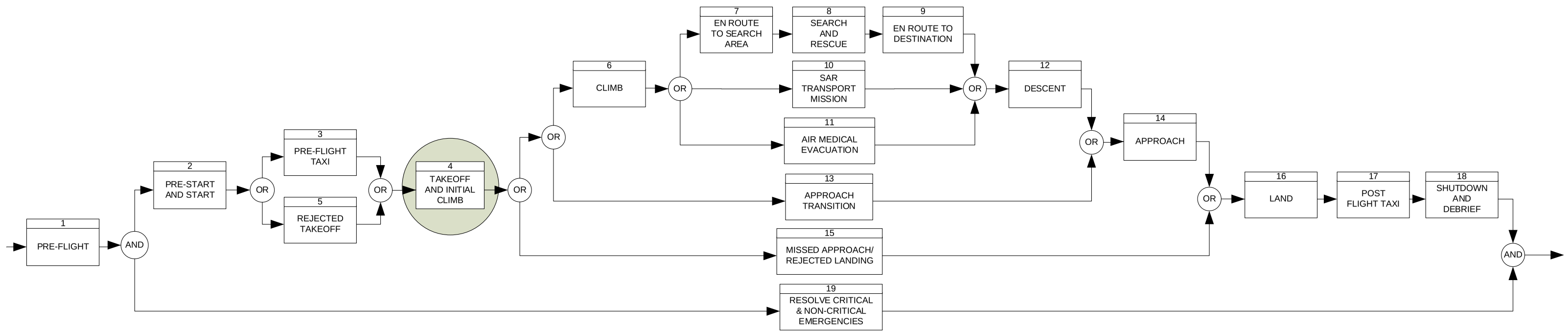


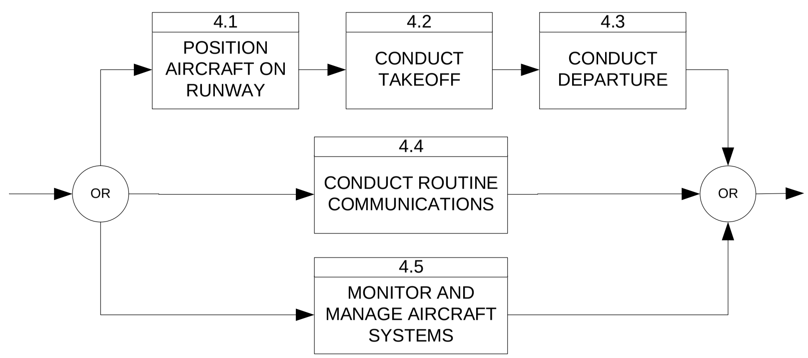
SEGMENT 2 – Pre-Start and Start



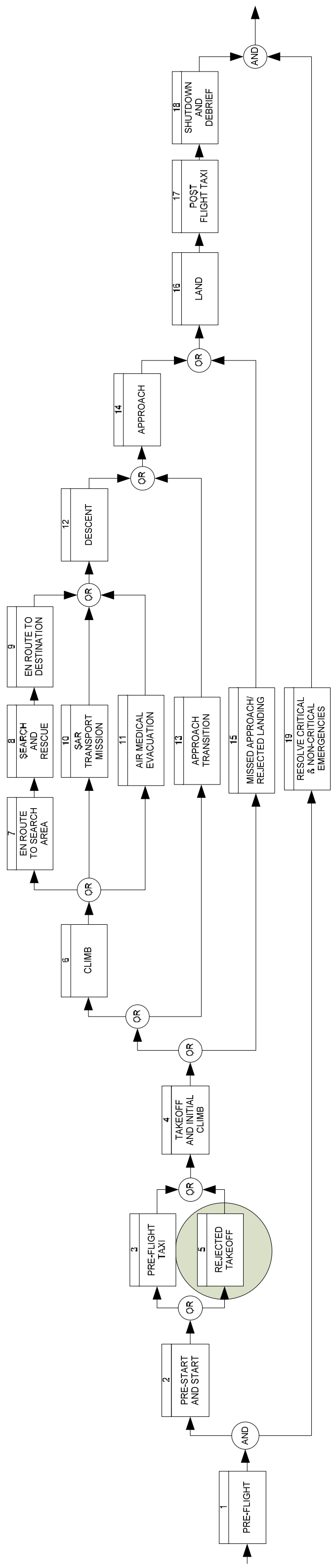


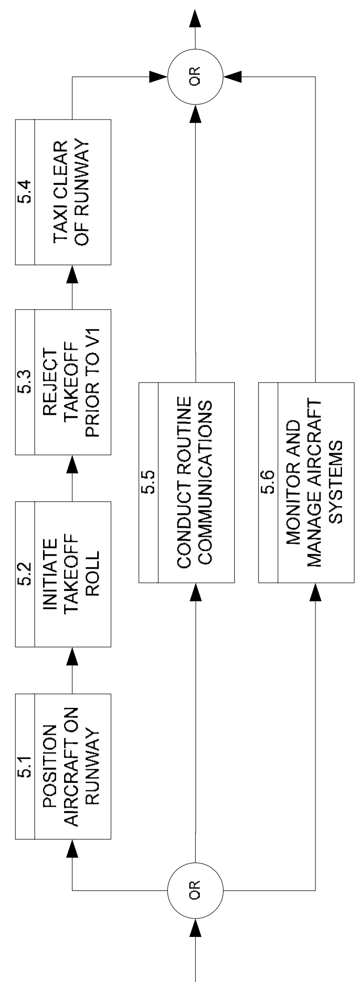
SEGMENT 3 – Pre-Flight Taxi



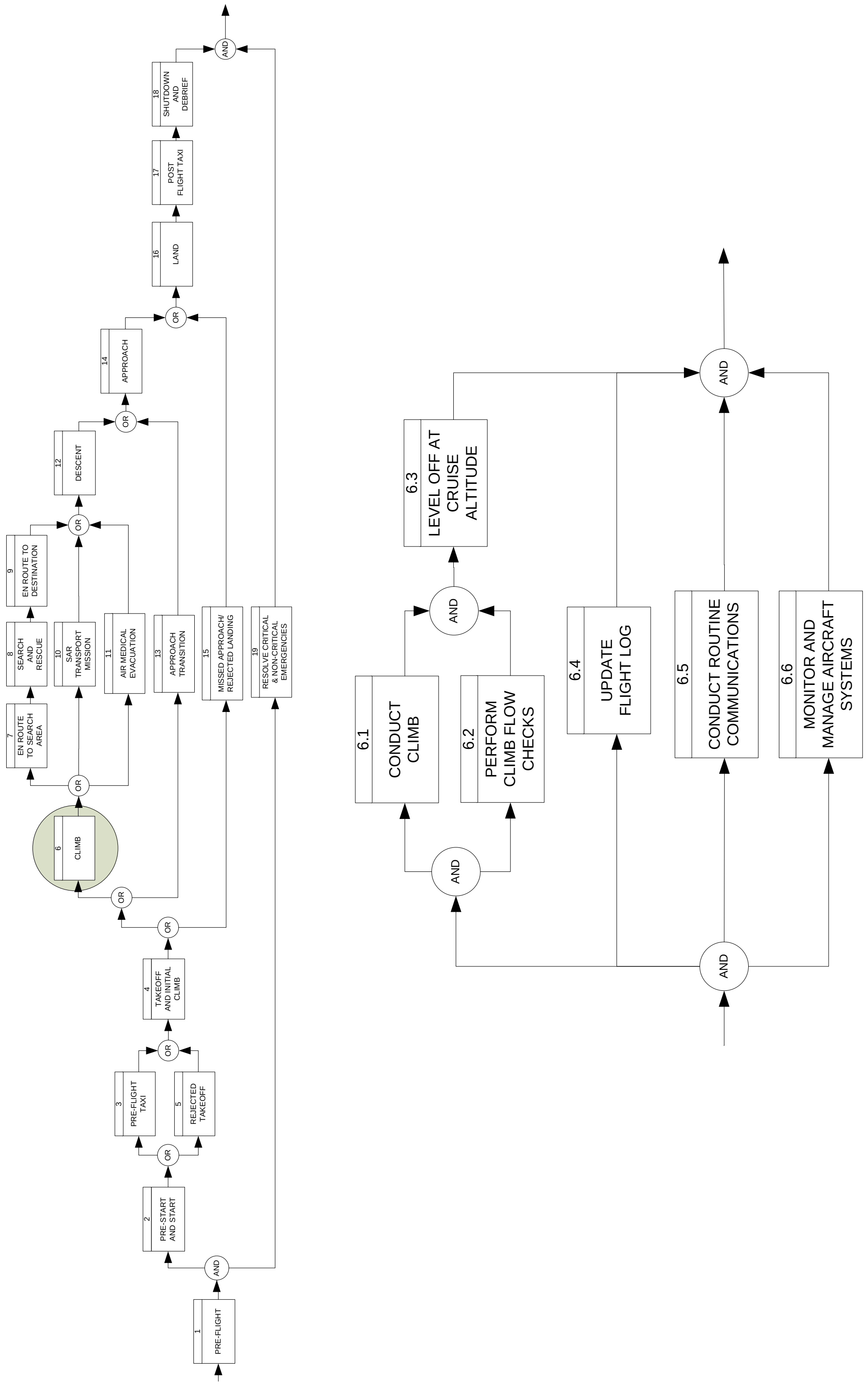


SEGMENT 4 – Takeoff and Initial Climb

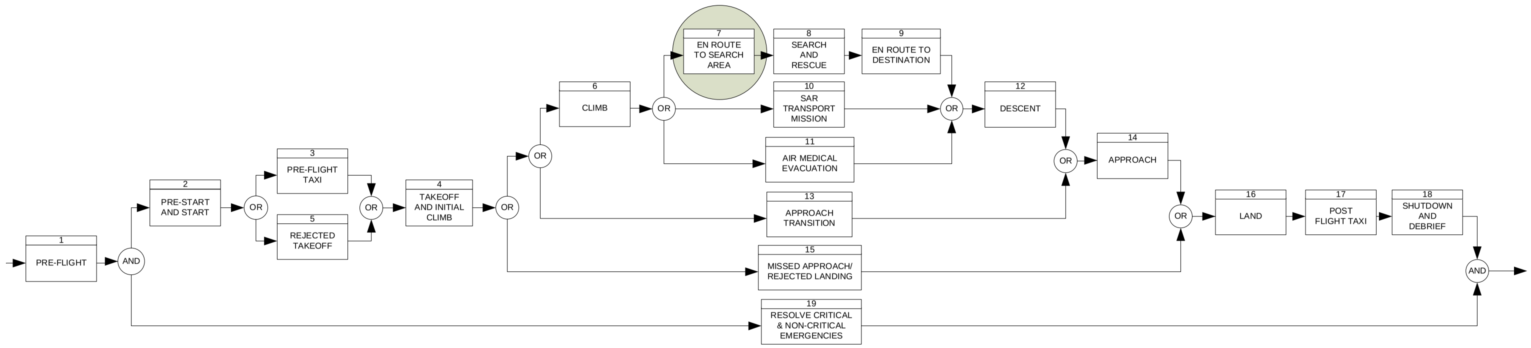


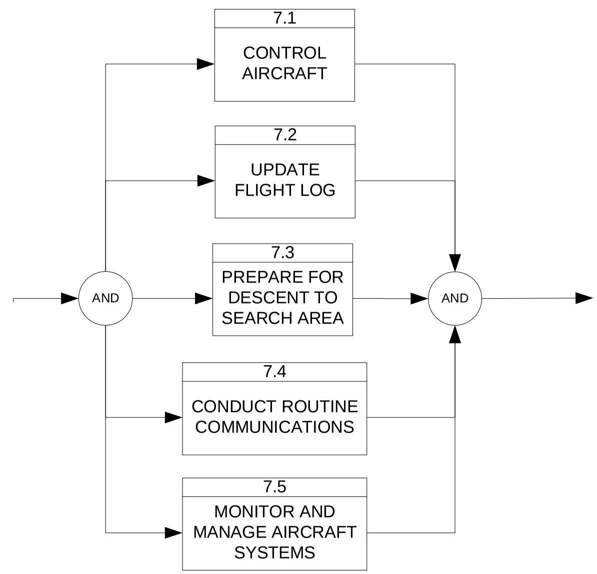


SEGMENT 5 – Reject Takeoff

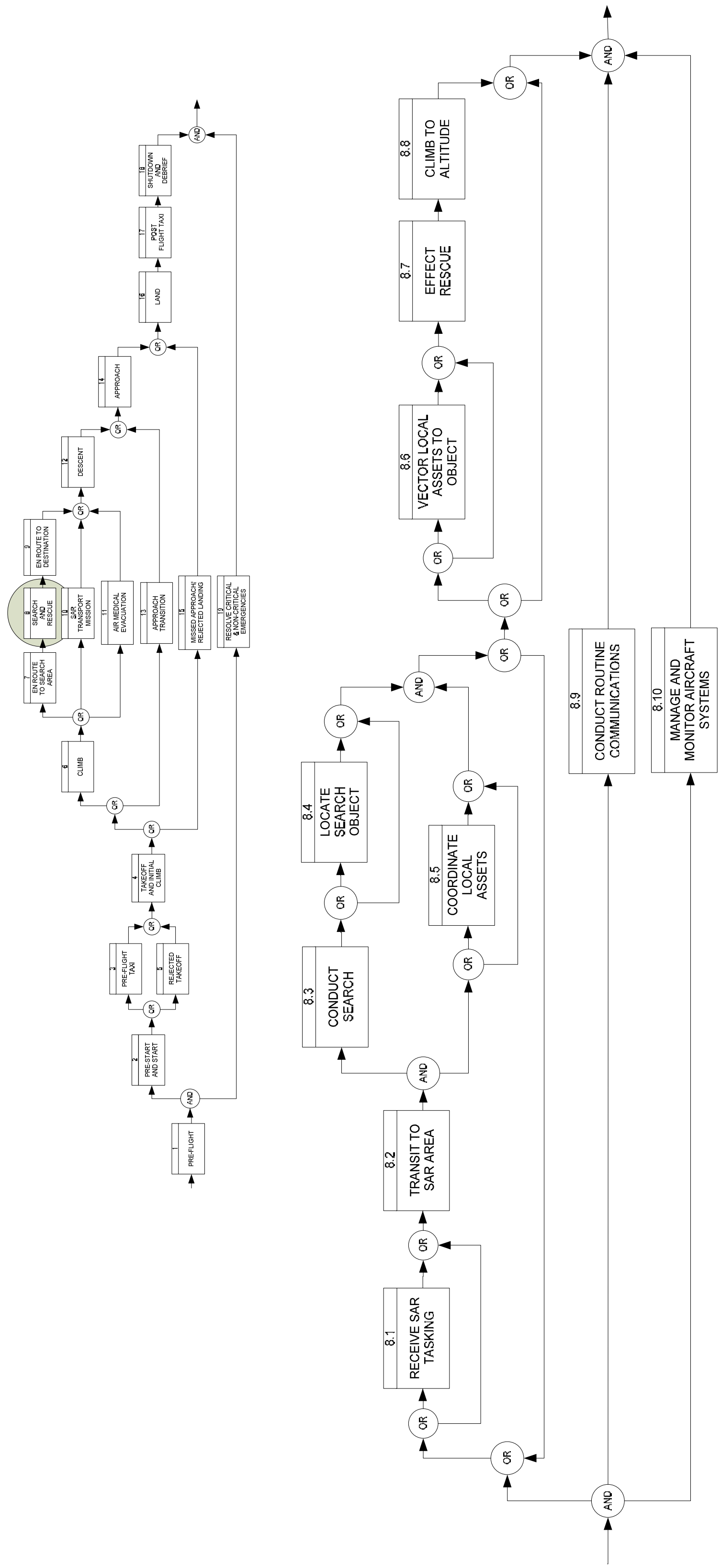


SEGMENT 6 – Climb

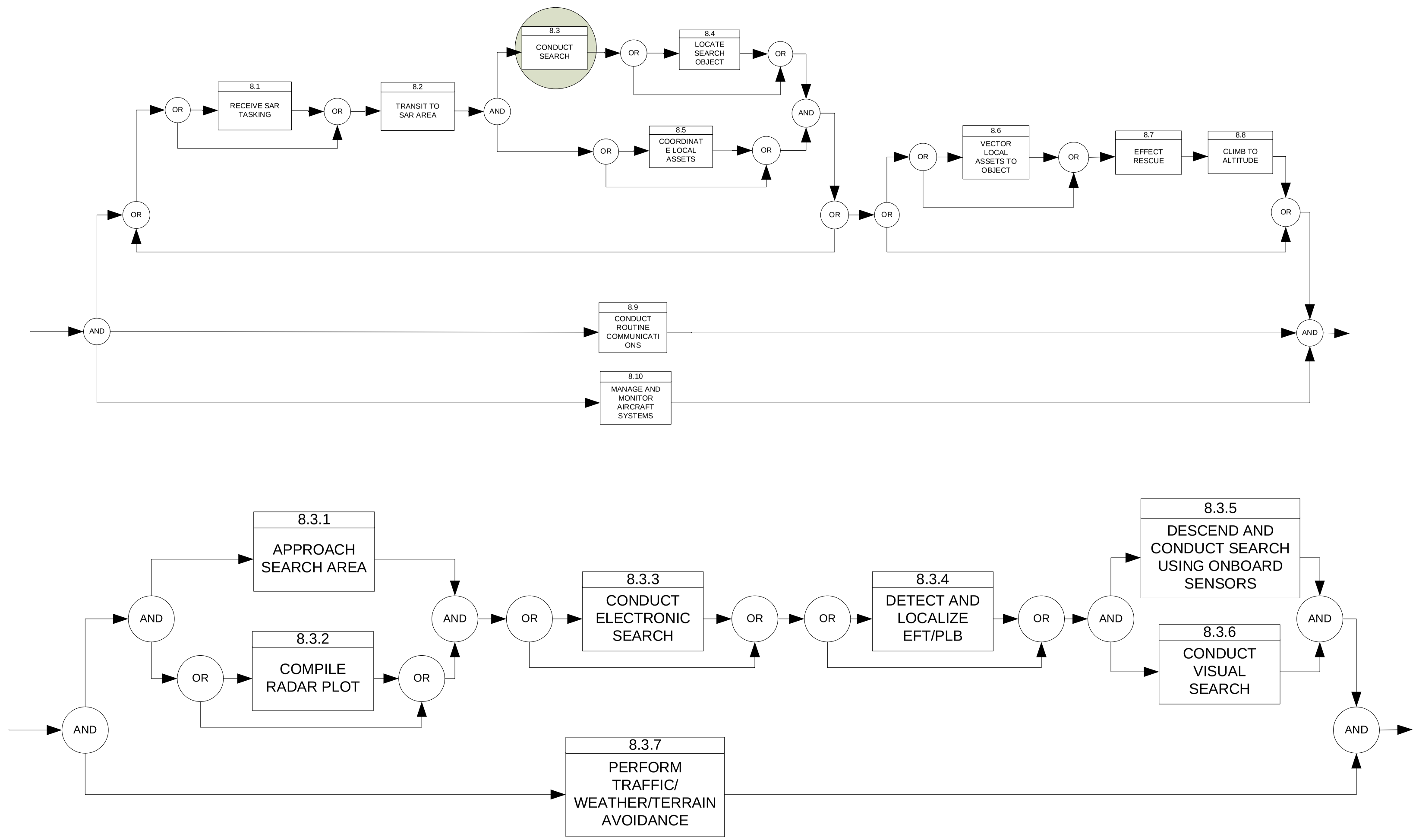




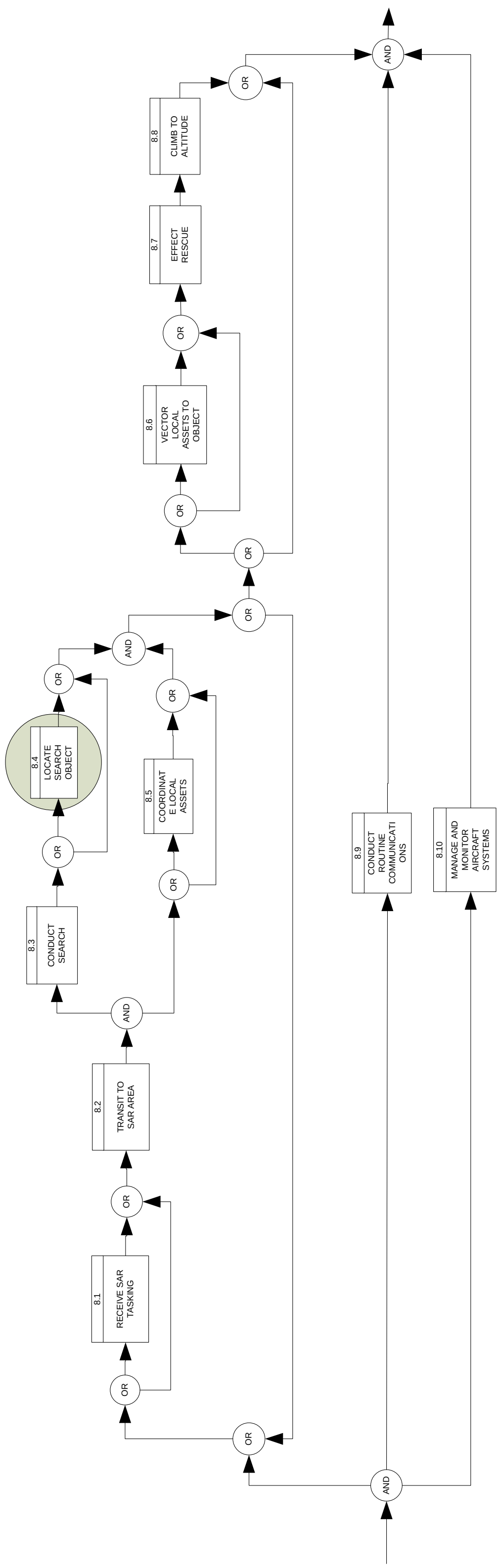
SEGMENT 7 – Enroute to Search Area

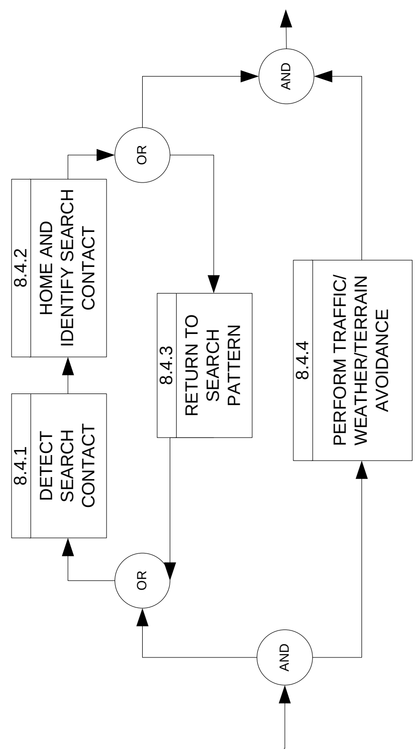


SEGMENT 8 – Search and Rescue

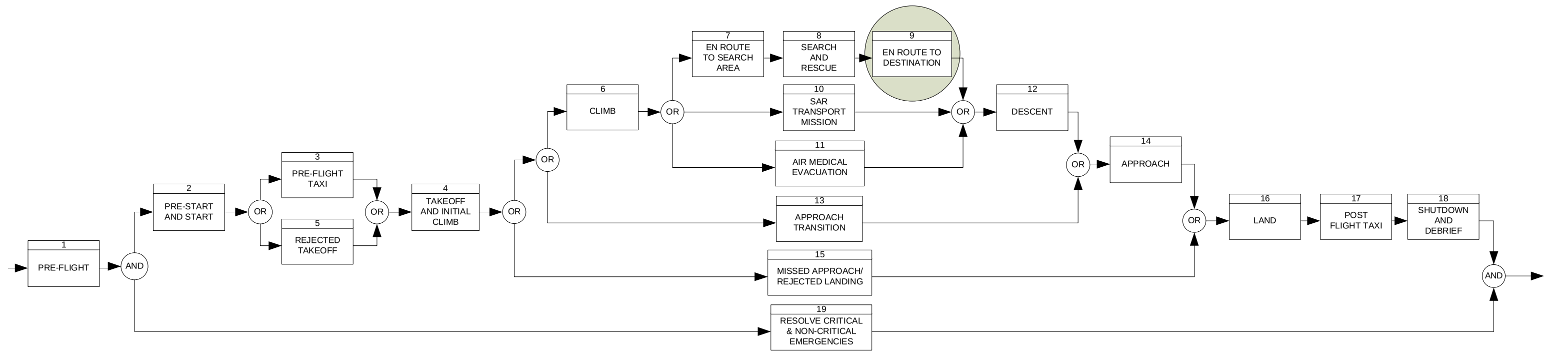


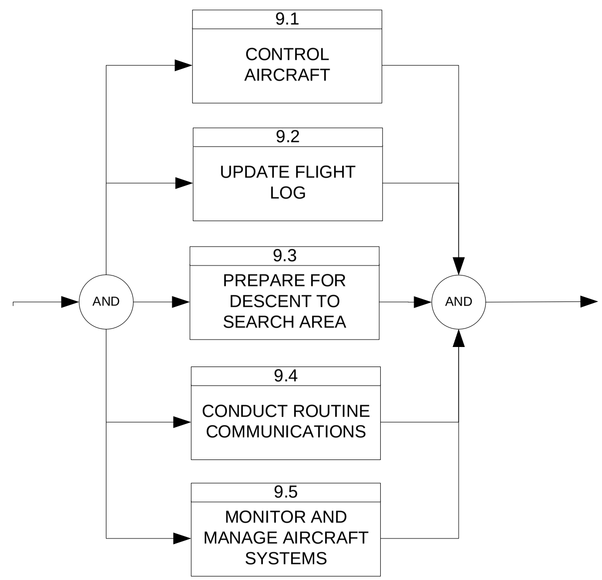
SEGMENT 8.3 – Conduct Search



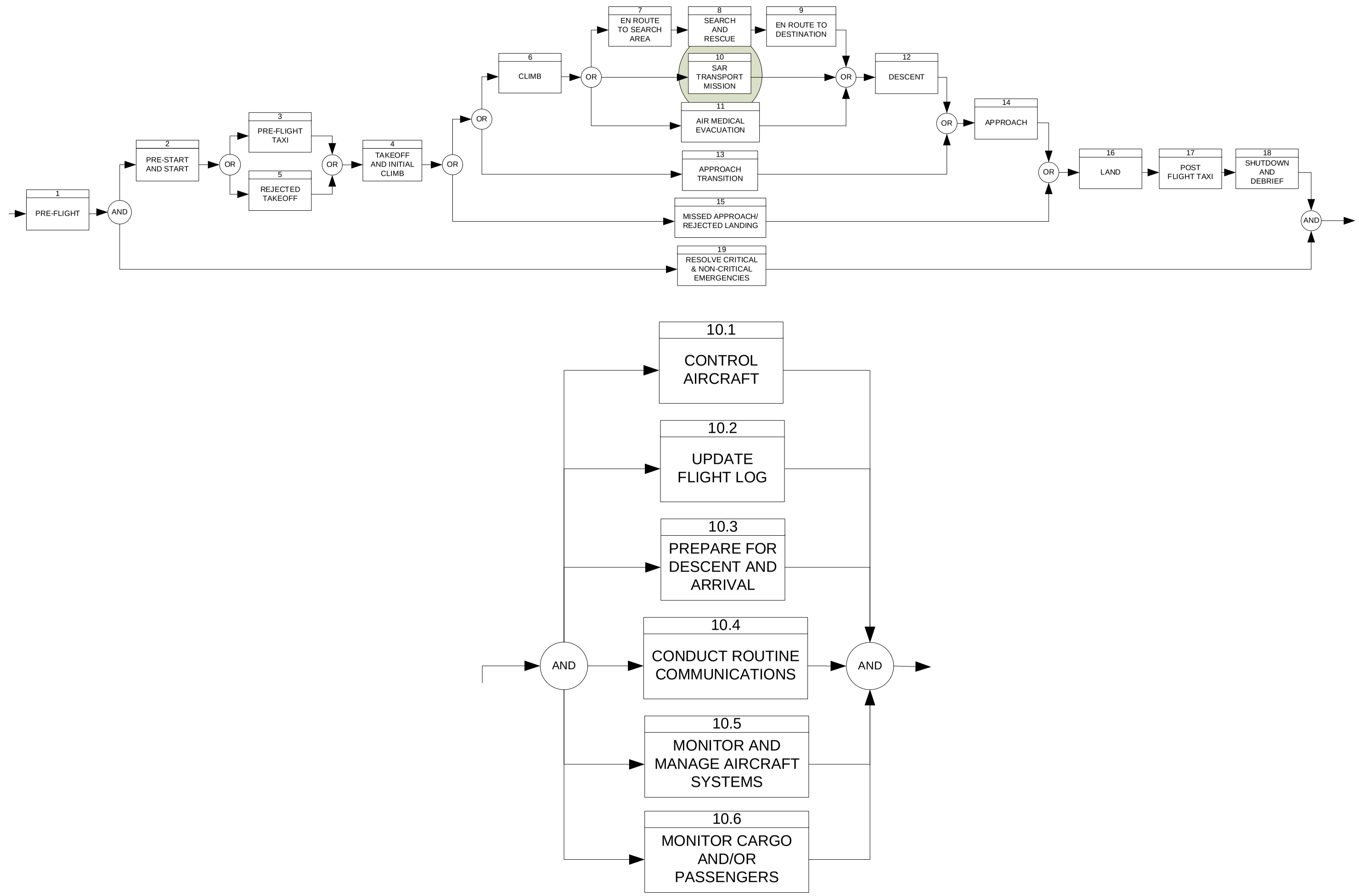


Segment 8.4 – Locate Object of Search

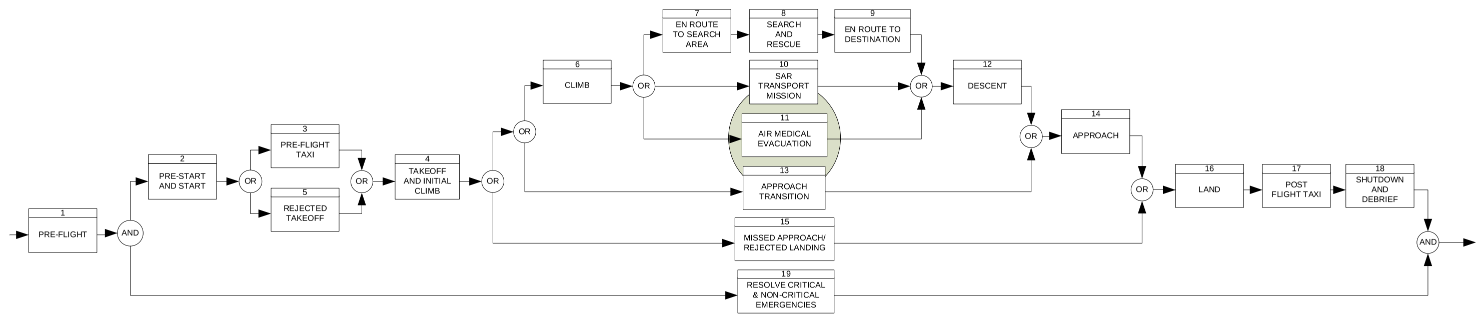


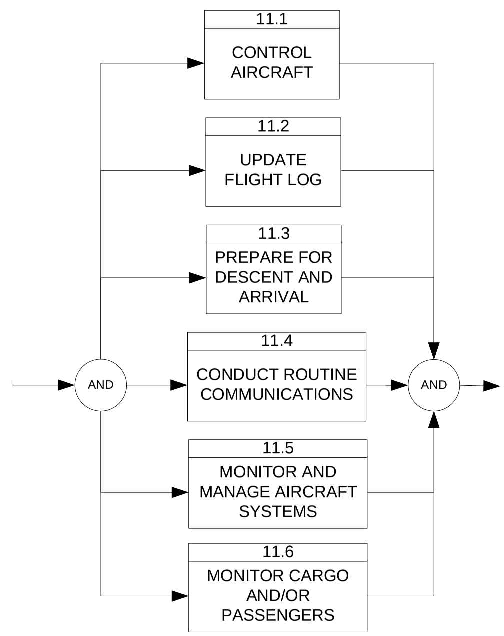


SECTION 9 – Enroute to Destination

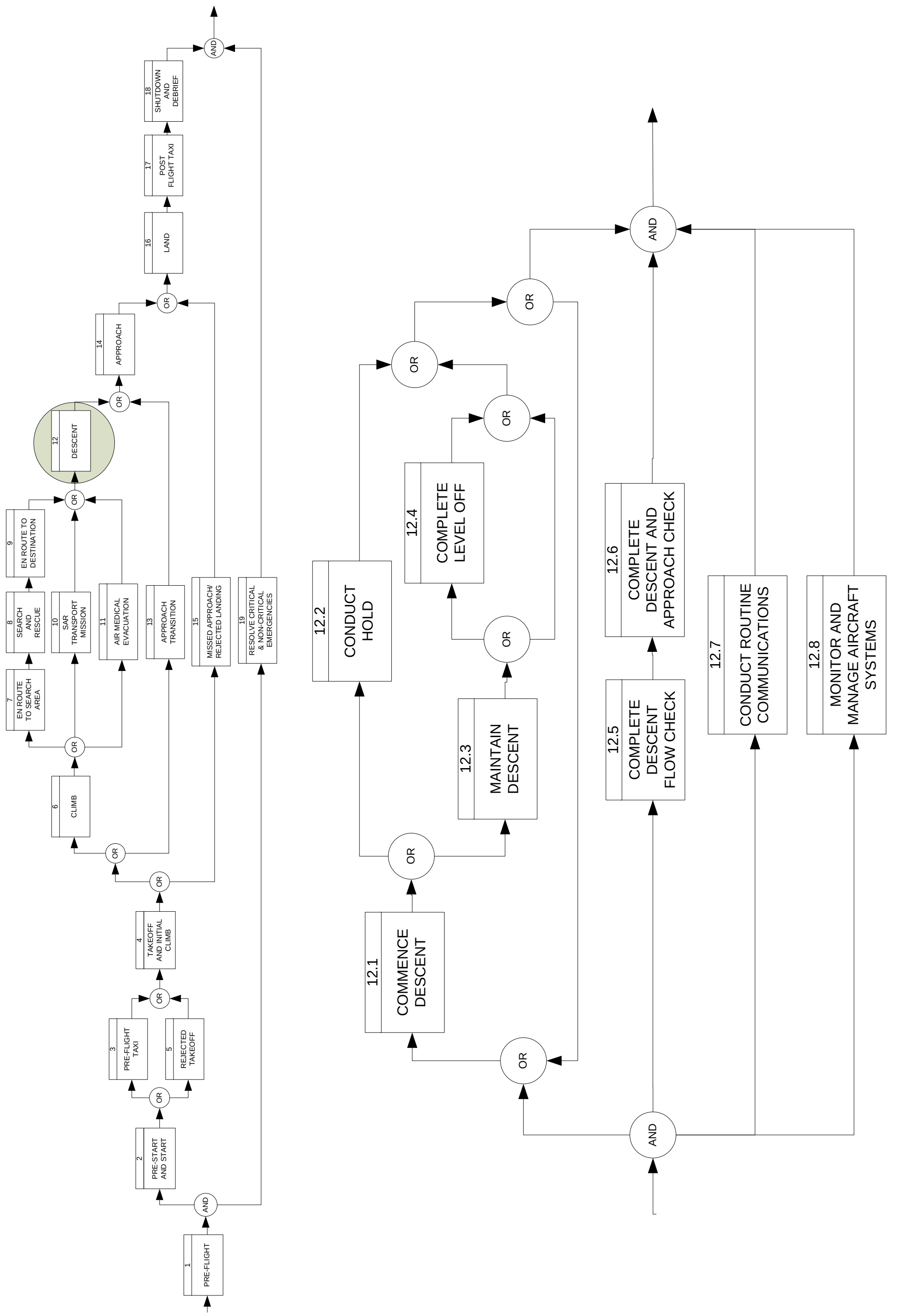


SECTION 10 – SAR Transport Mission

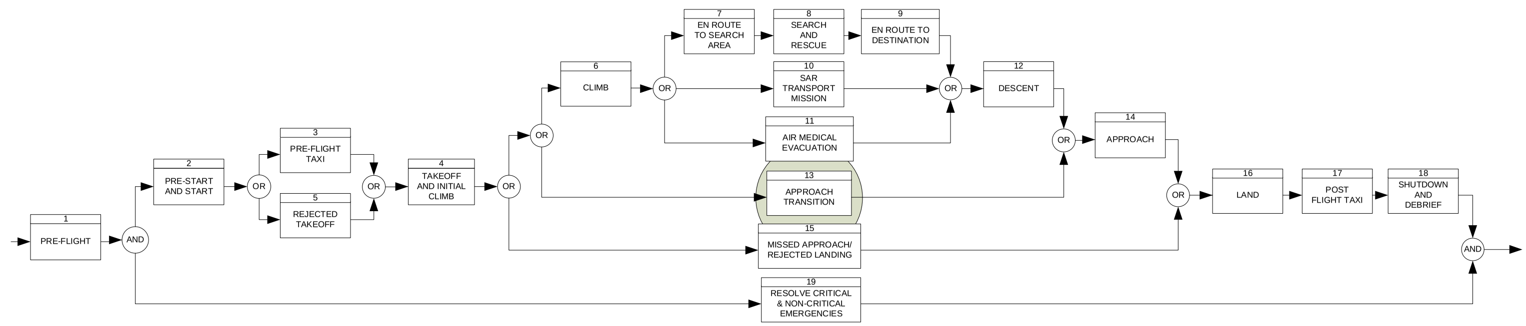


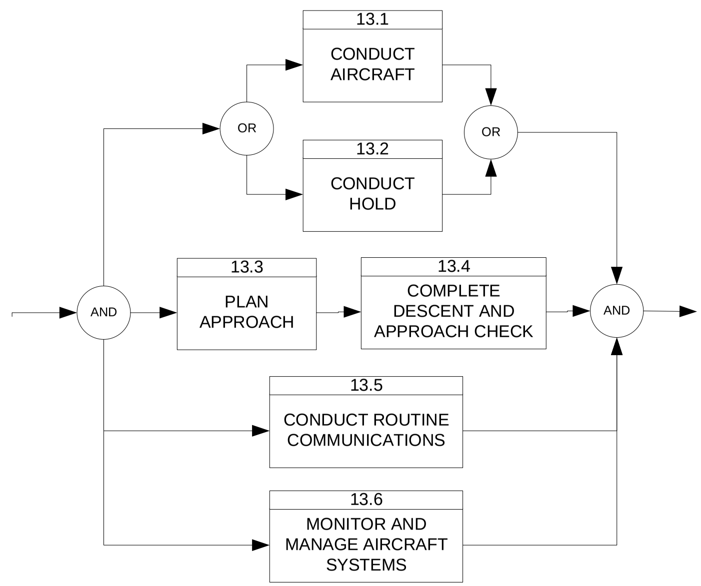


SECTION 11 – Aeromedical Evacuation

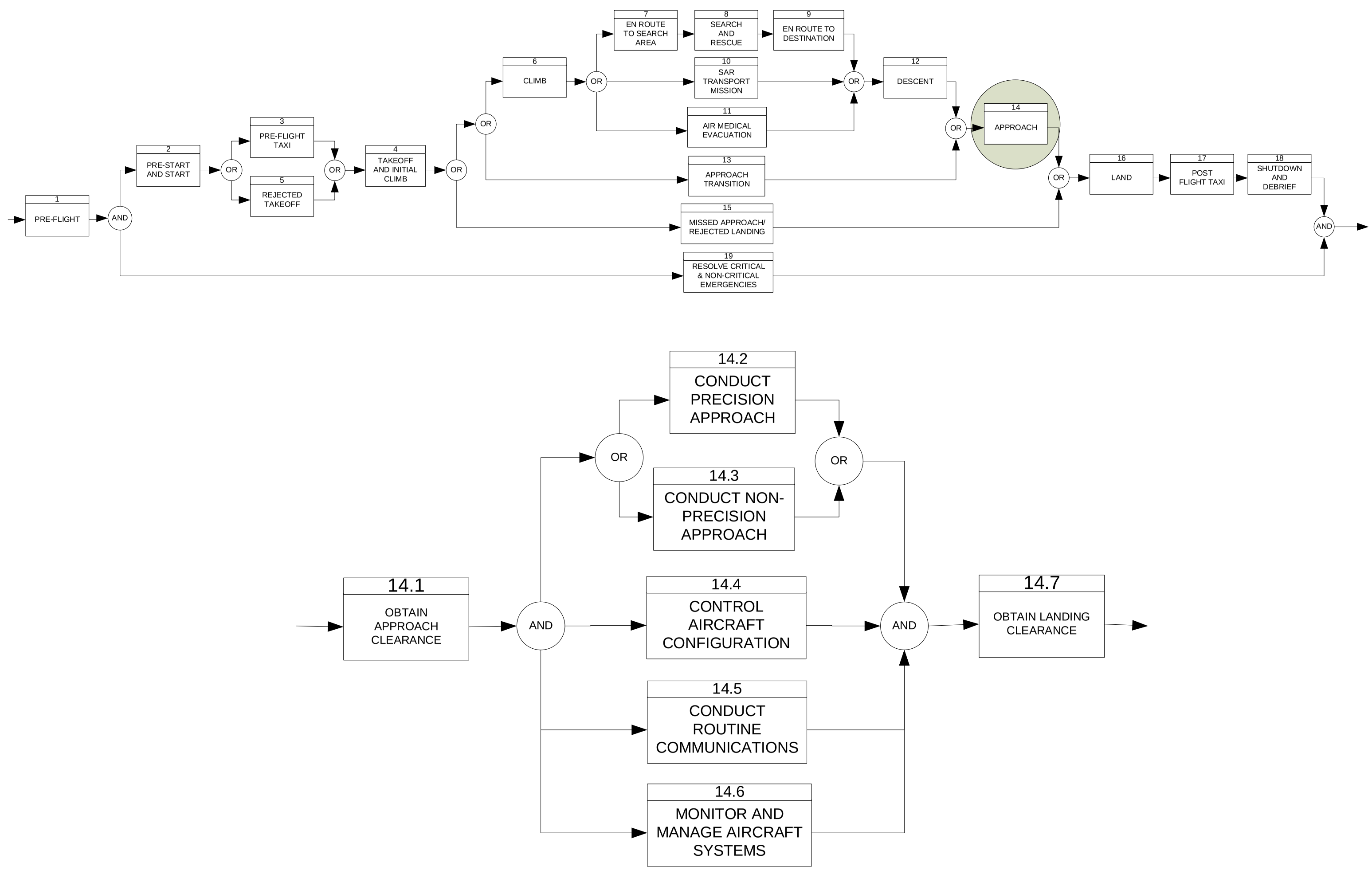


SECTION 12 – Descent

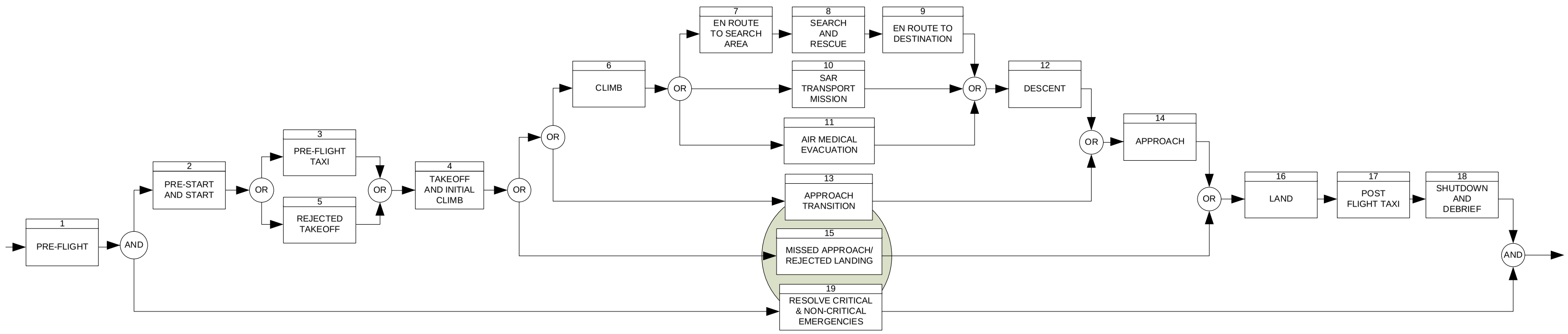


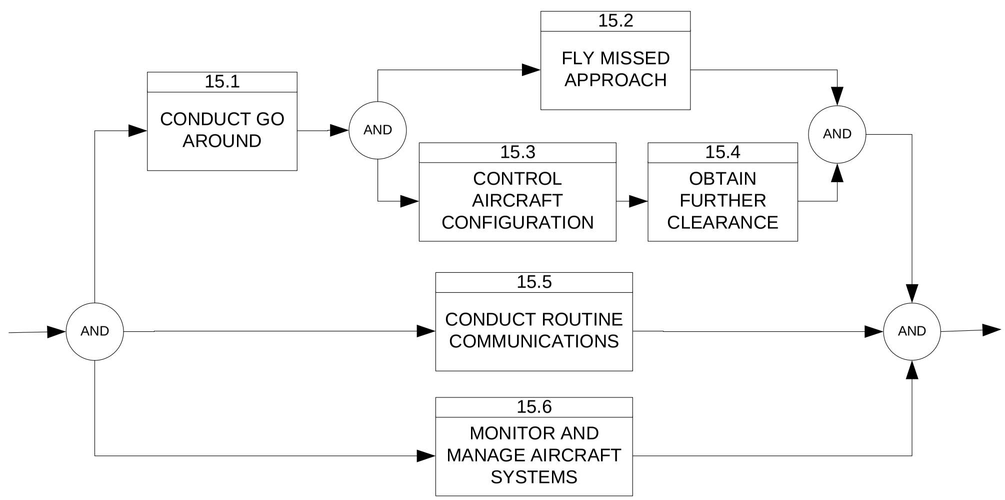


SECTION 13 – Approach Transition

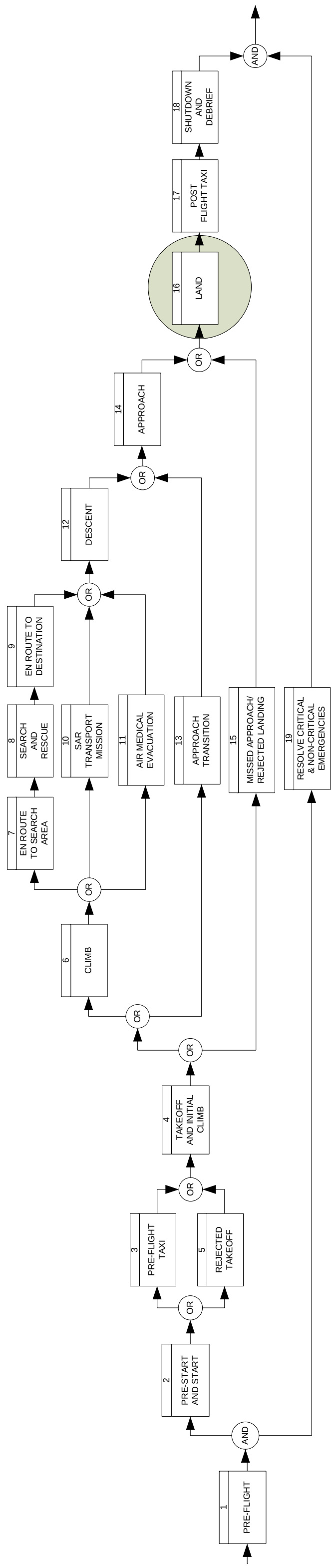


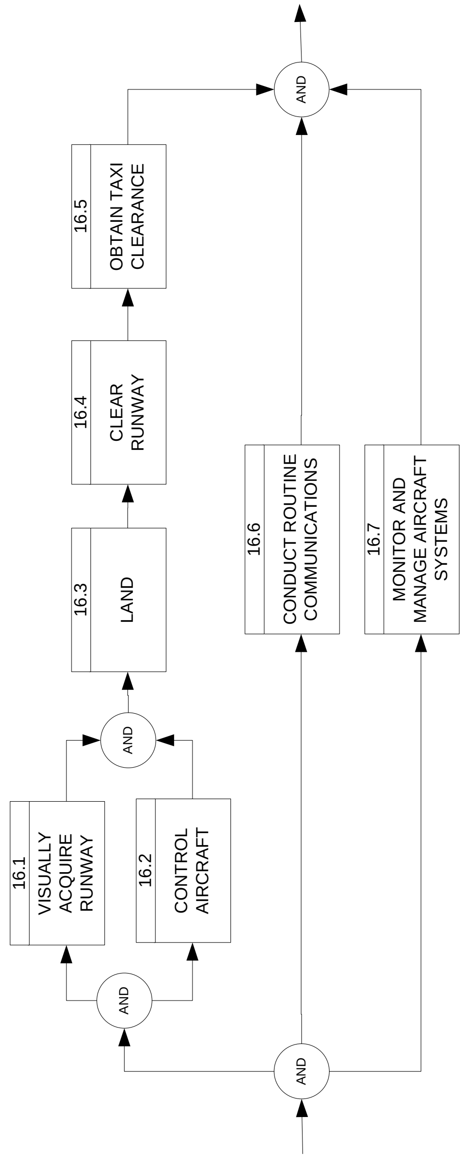
SECTION 14 – Approach



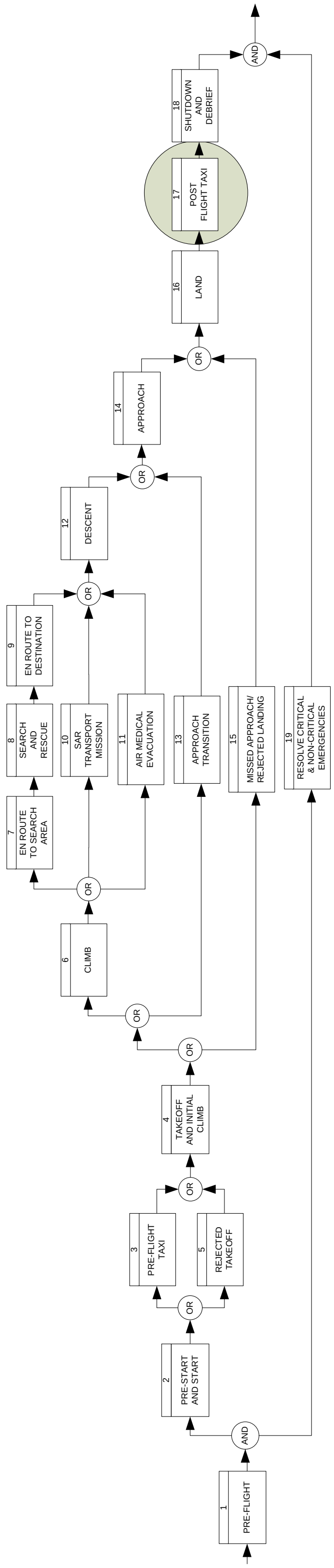


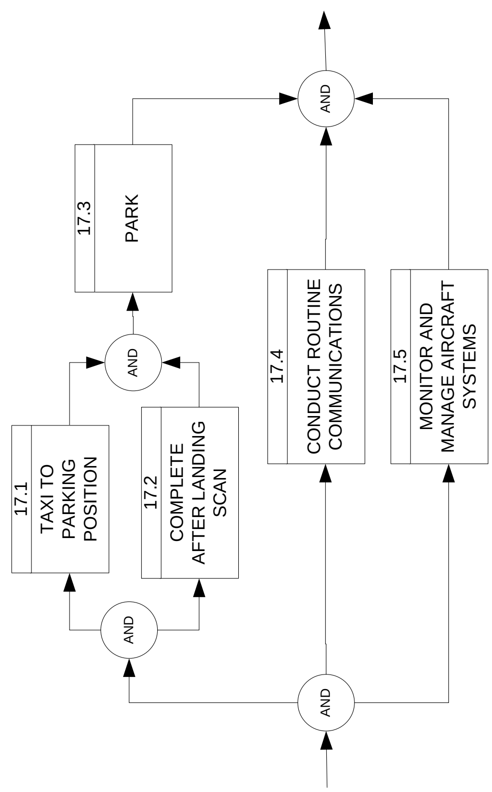
SECTION 15 – Missed Approach/Rejected Landing



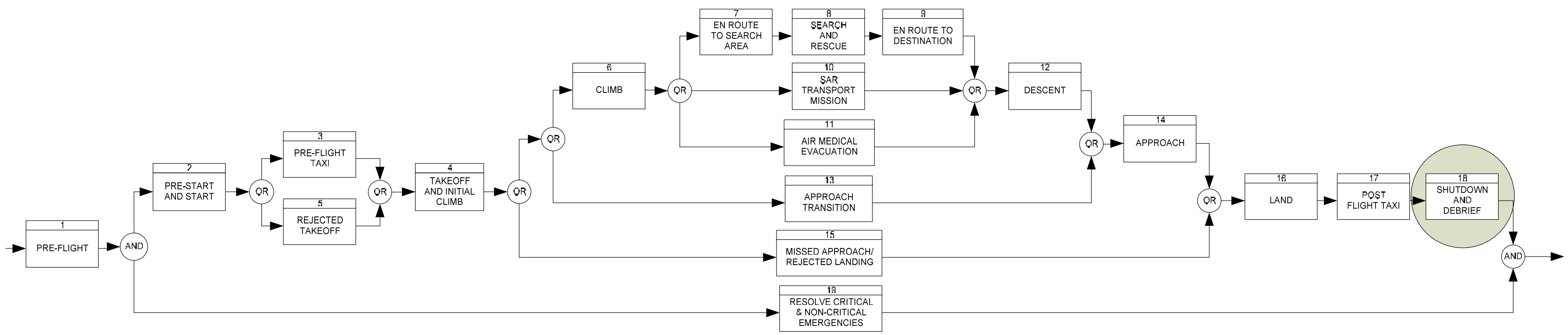


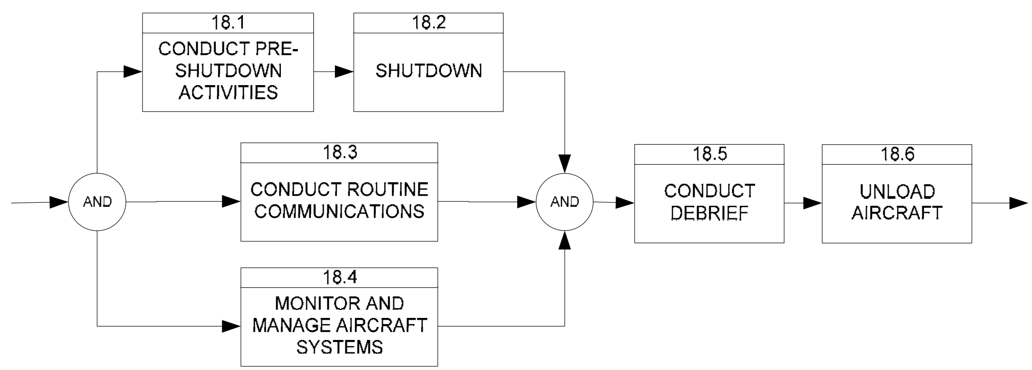
SECTION 16 – Land



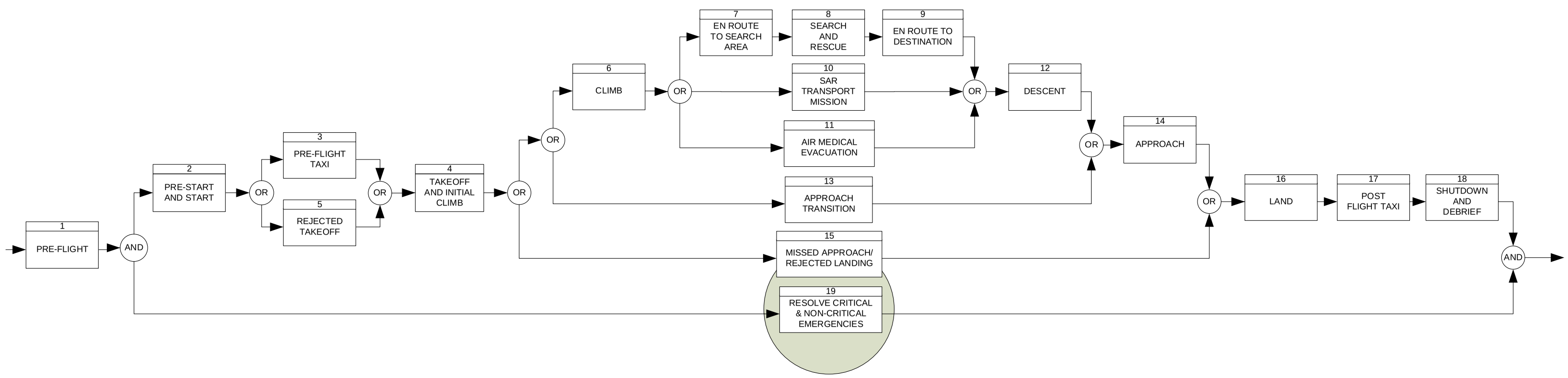


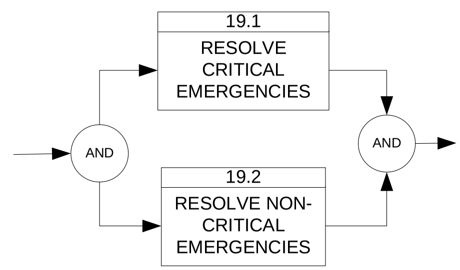
SECTION 17 – Post Flight Taxi





SECTION 18 – Shutdown and Debrief



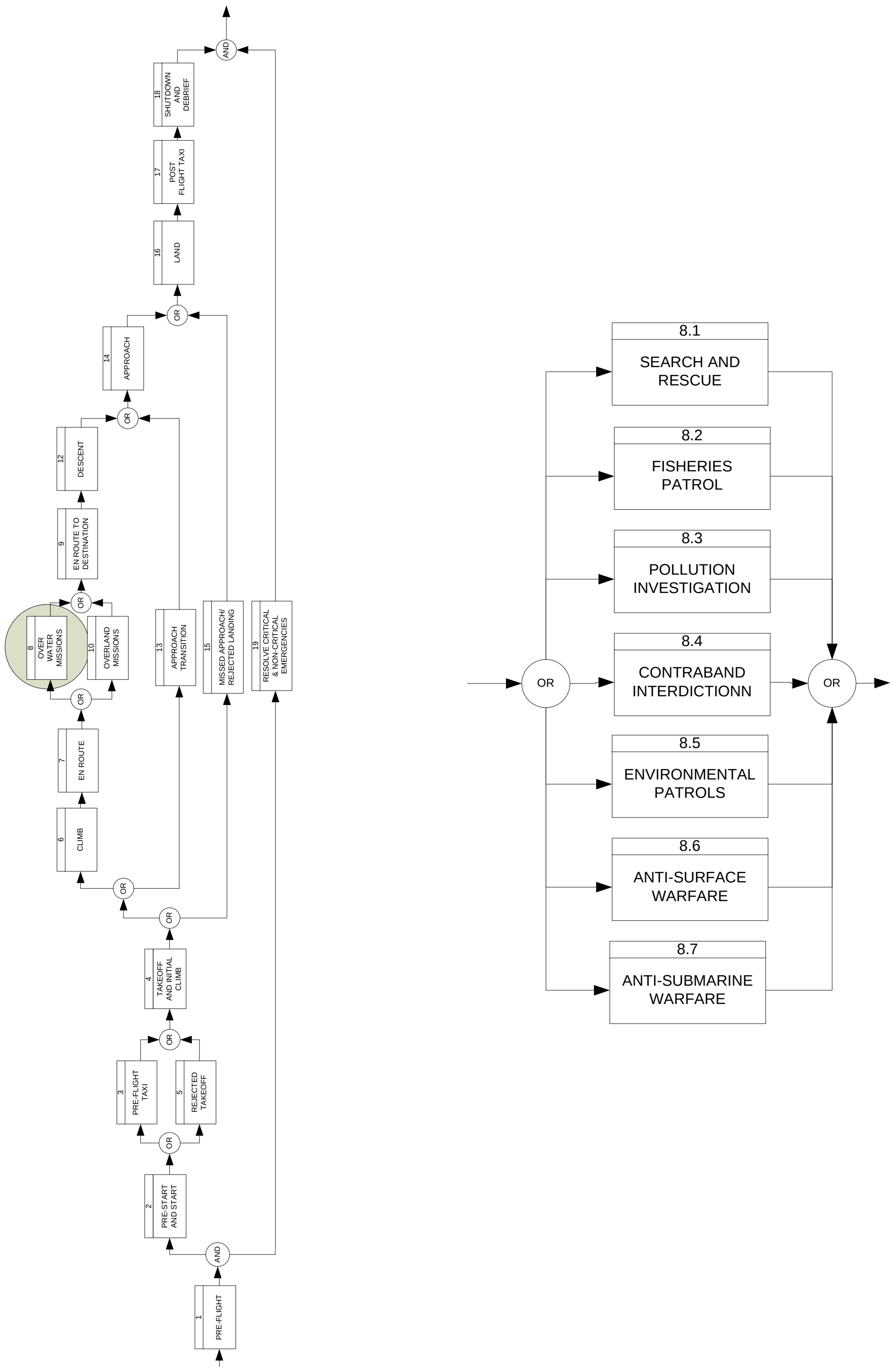


SECTION 19 – Resolve Critical and Non-Critical Emergencies

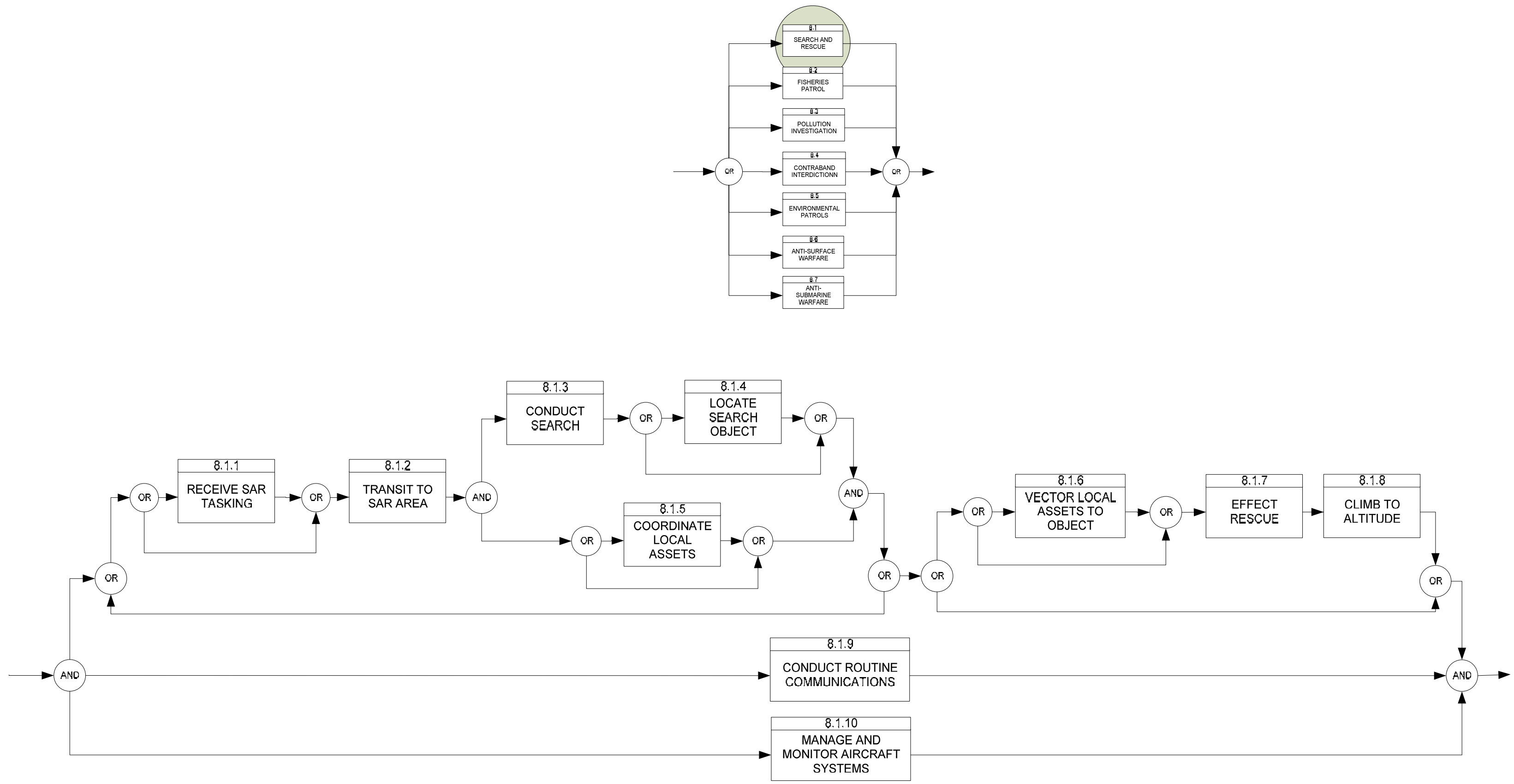
C.2 CP-140 AIMP Function Flow Diagrams

The FFDs for the CP-140 AIMP aircraft represent the top-, first-, and pertinent second-level functions. FFDs for lower-level functions were limited to those segments whereby the AIMS system will play a role in the conduct of the CP-140 mission. In addition, only a representative subset of CP-140 missions is depicted with FFDs.

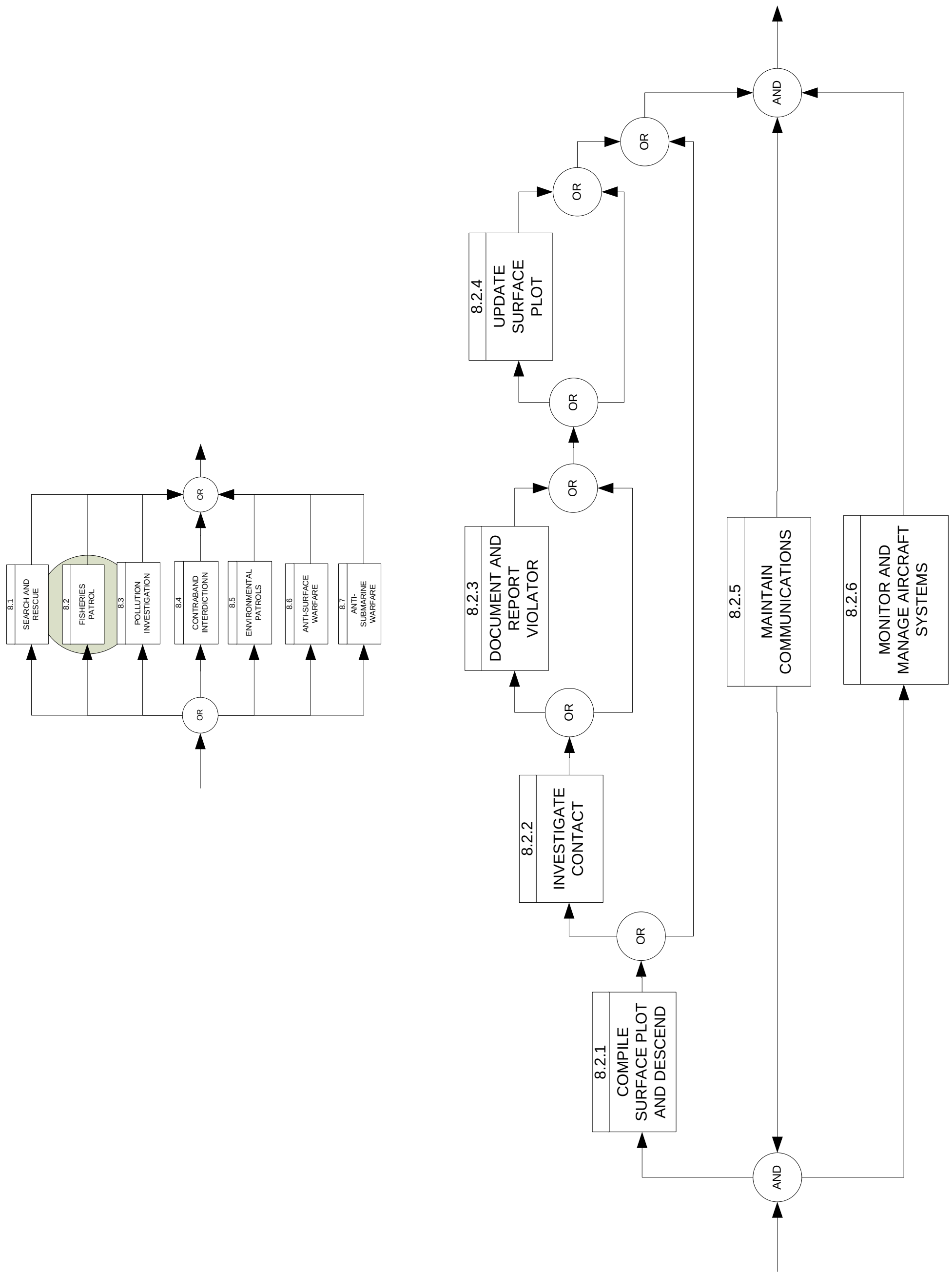
All top- and first-level functions related to the pre- and post-mission activities are identical for both the FWSAR and CP-140 aircrafts. As such, these FFDs are not duplicated with the remainder of the CP-140 FFDs.



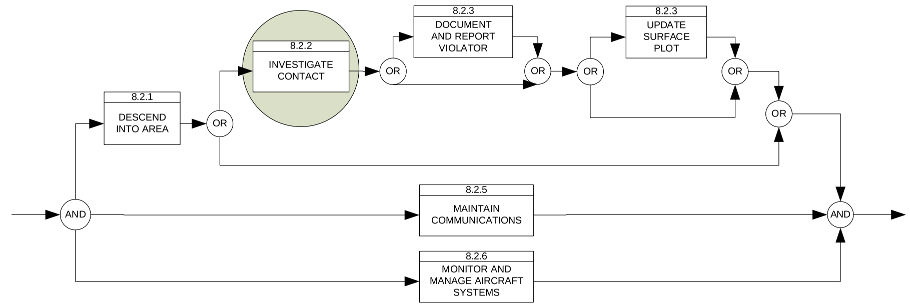
SEGMENT 8 – Missions Over Water

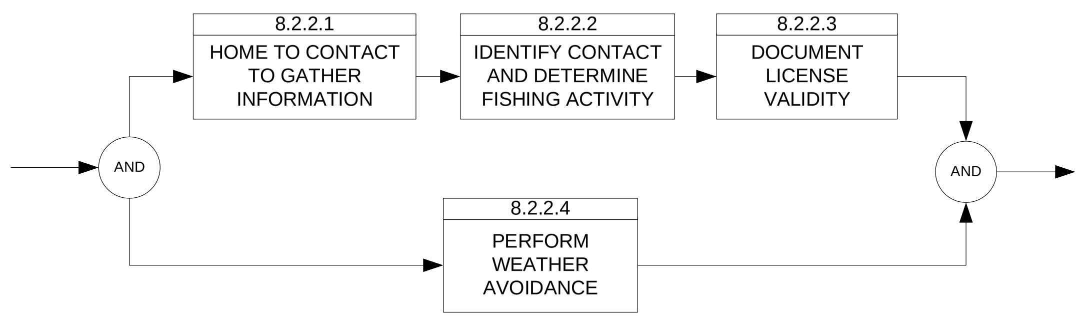


SEGMENT 8.1 – Search and Rescue

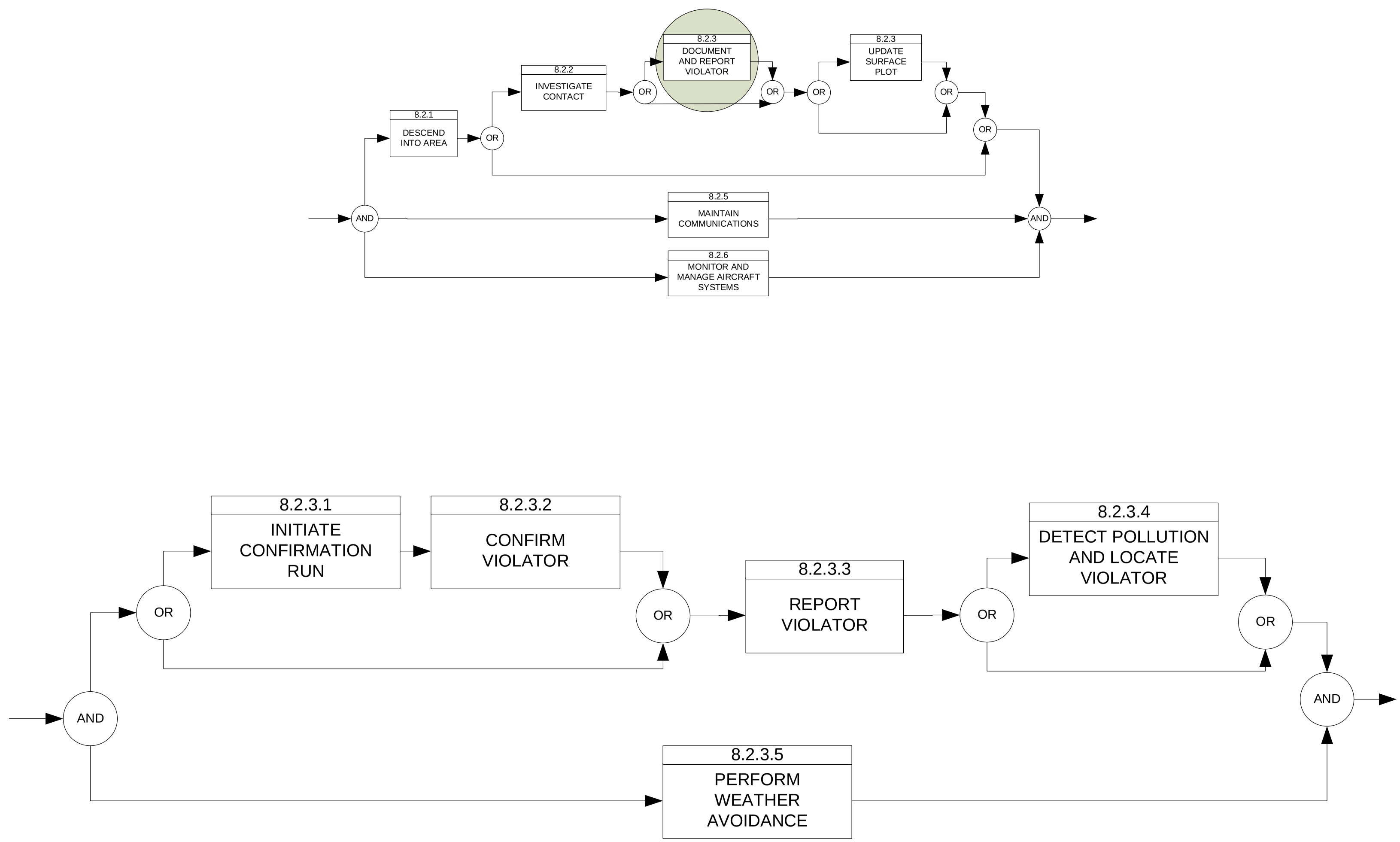


SEGMENT 8.2 – Fisheries Patrol

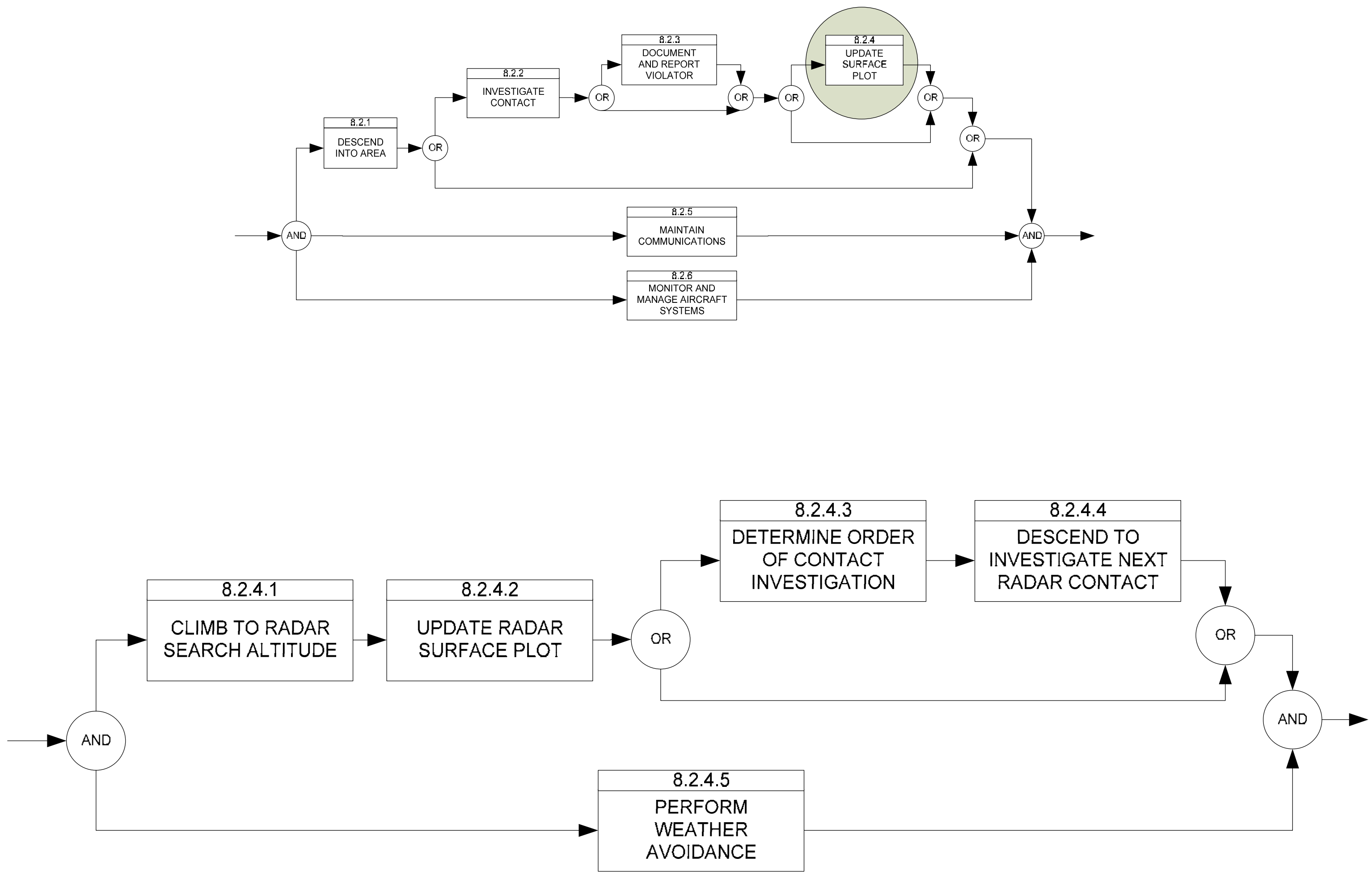




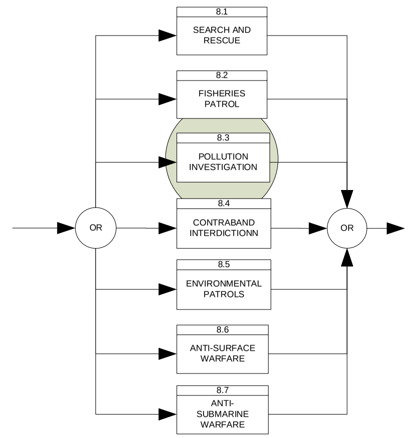
SEGMENT 8.2.2 – Investigate Contact

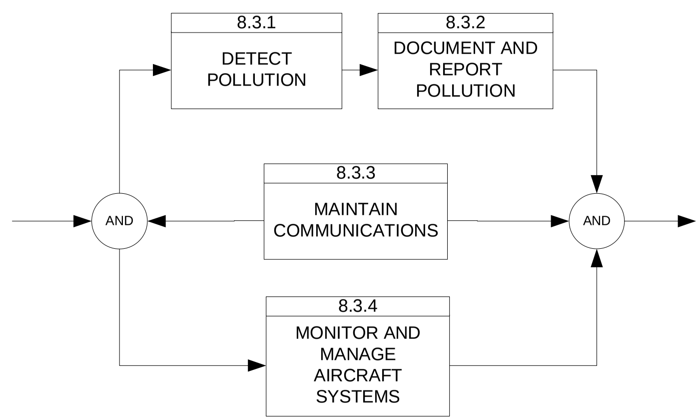


SEGMENT 8.2.3 – Document and Report Violator

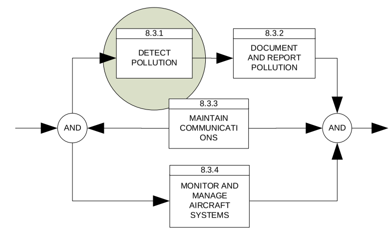


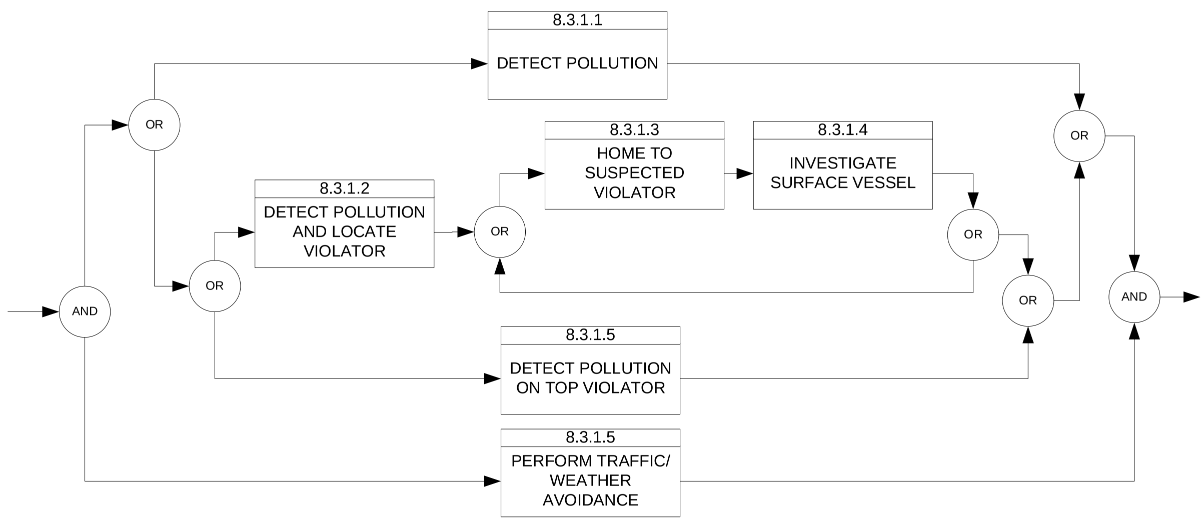
SEGEMENT 8.2.4 – Update Surface Plot



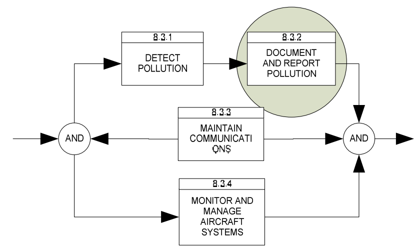


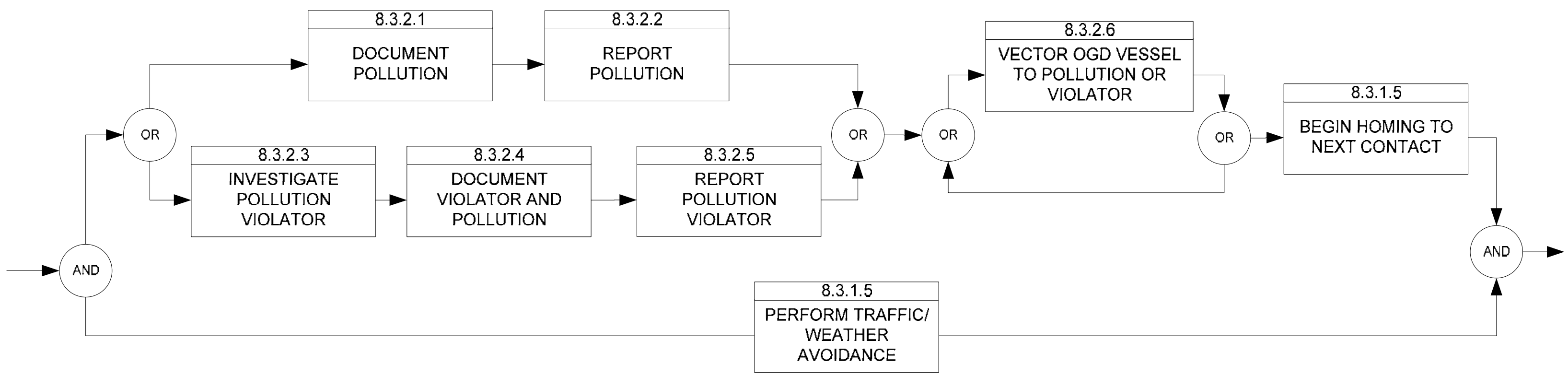
SEGMENT 8.3 – Pollution Investigation



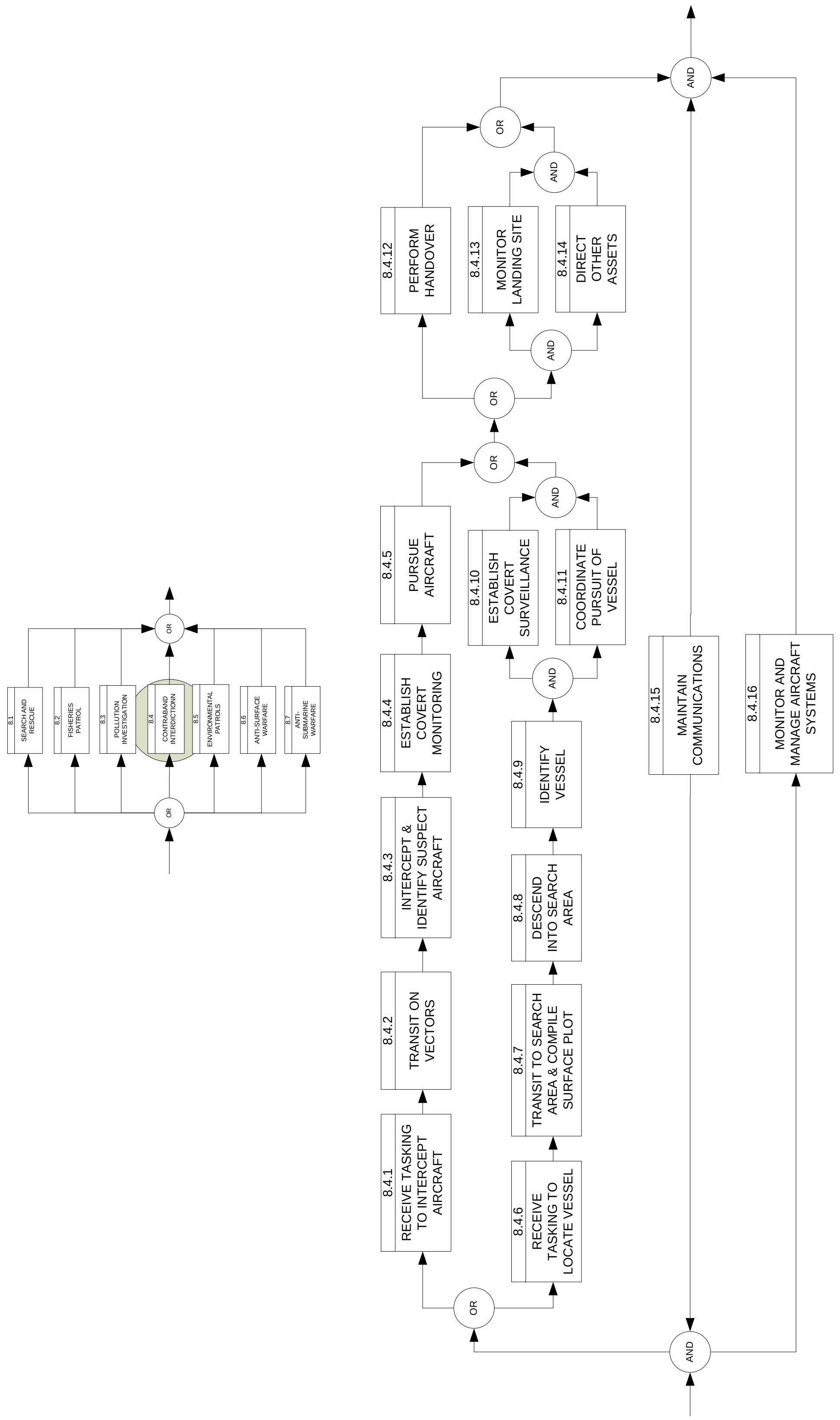


SEGMENT 8.3.1 – Detect Pollution

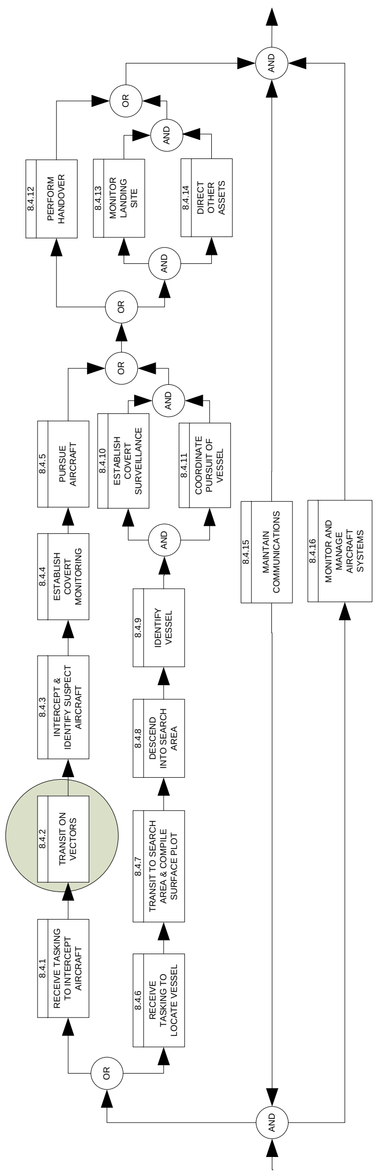


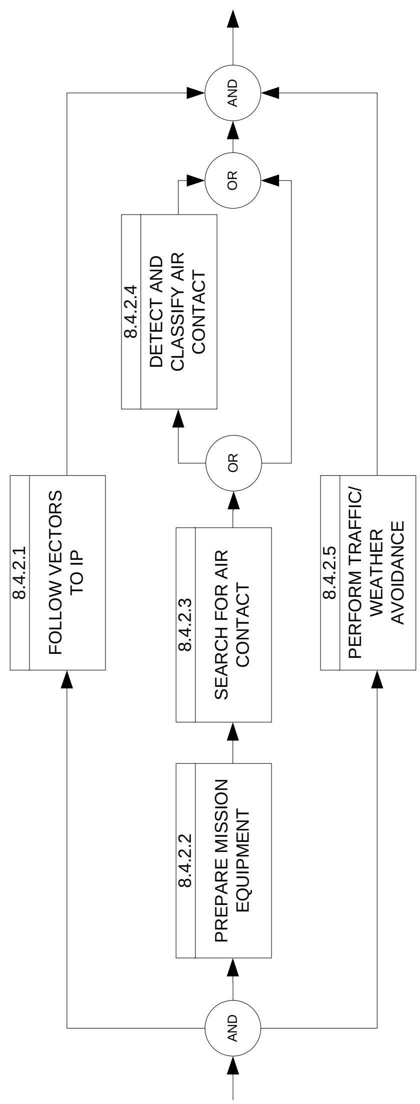


SEGMENT 8.3.2 – Document and Report Pollution

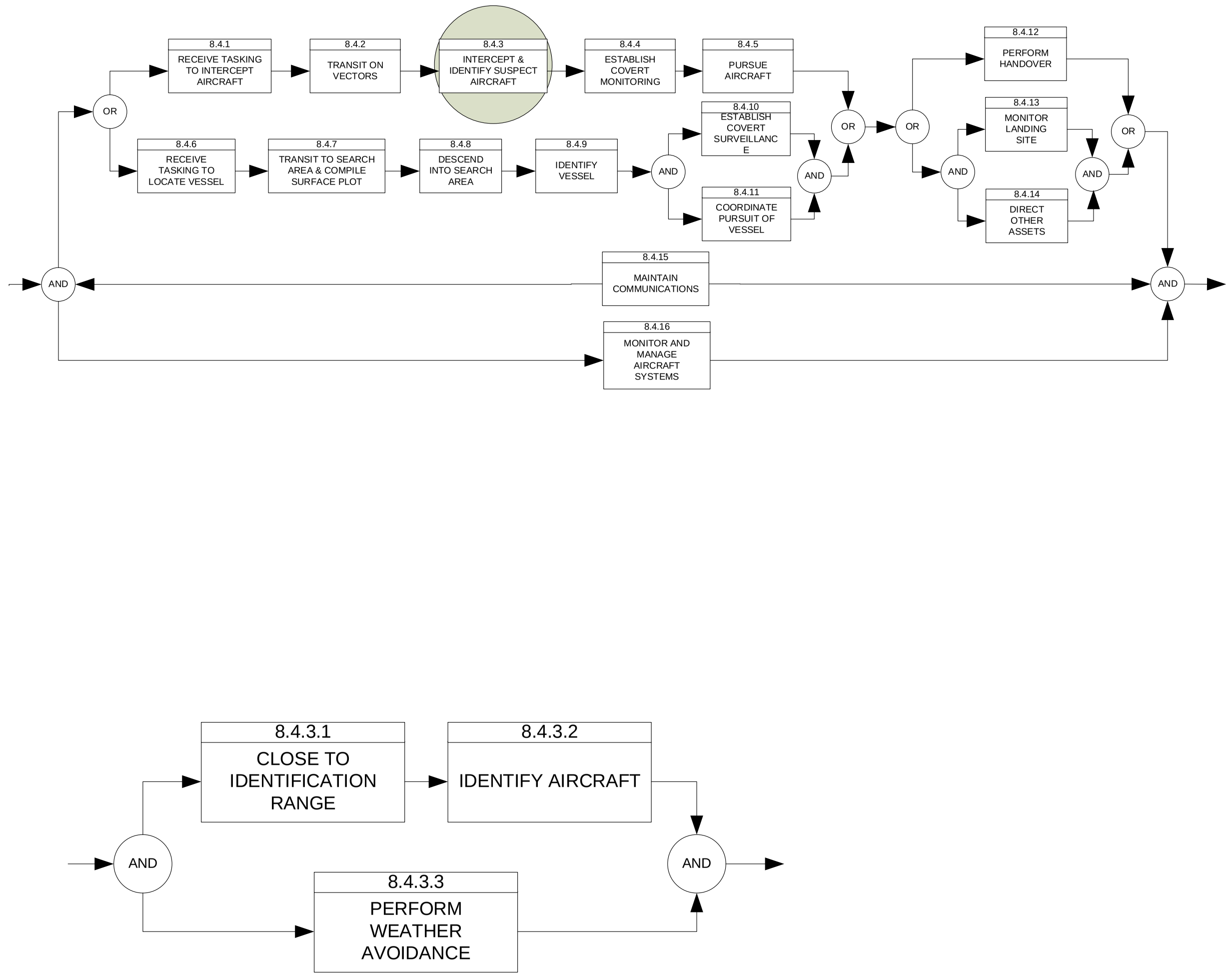


SEGMENT 8.4 – Contraband Interdiction

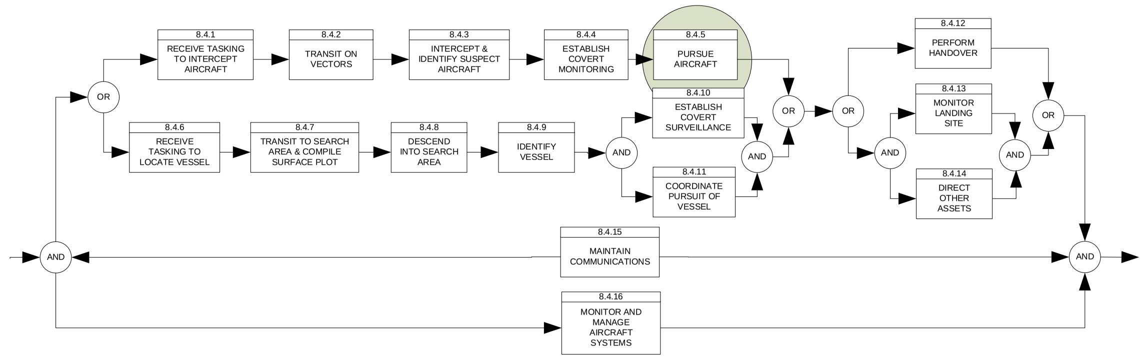


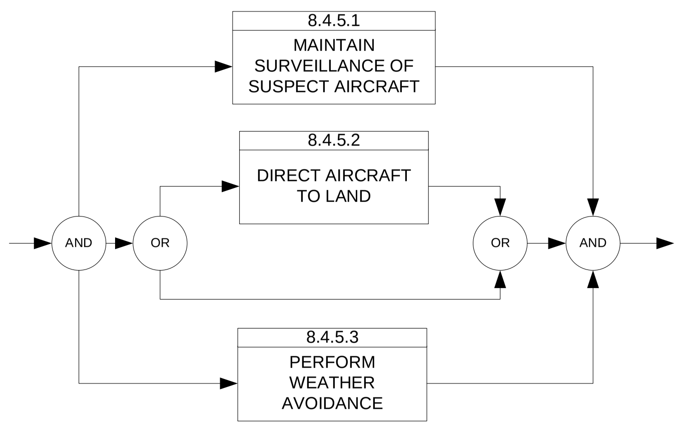


SEGMENT 8.4.2 – Transit on Vectors

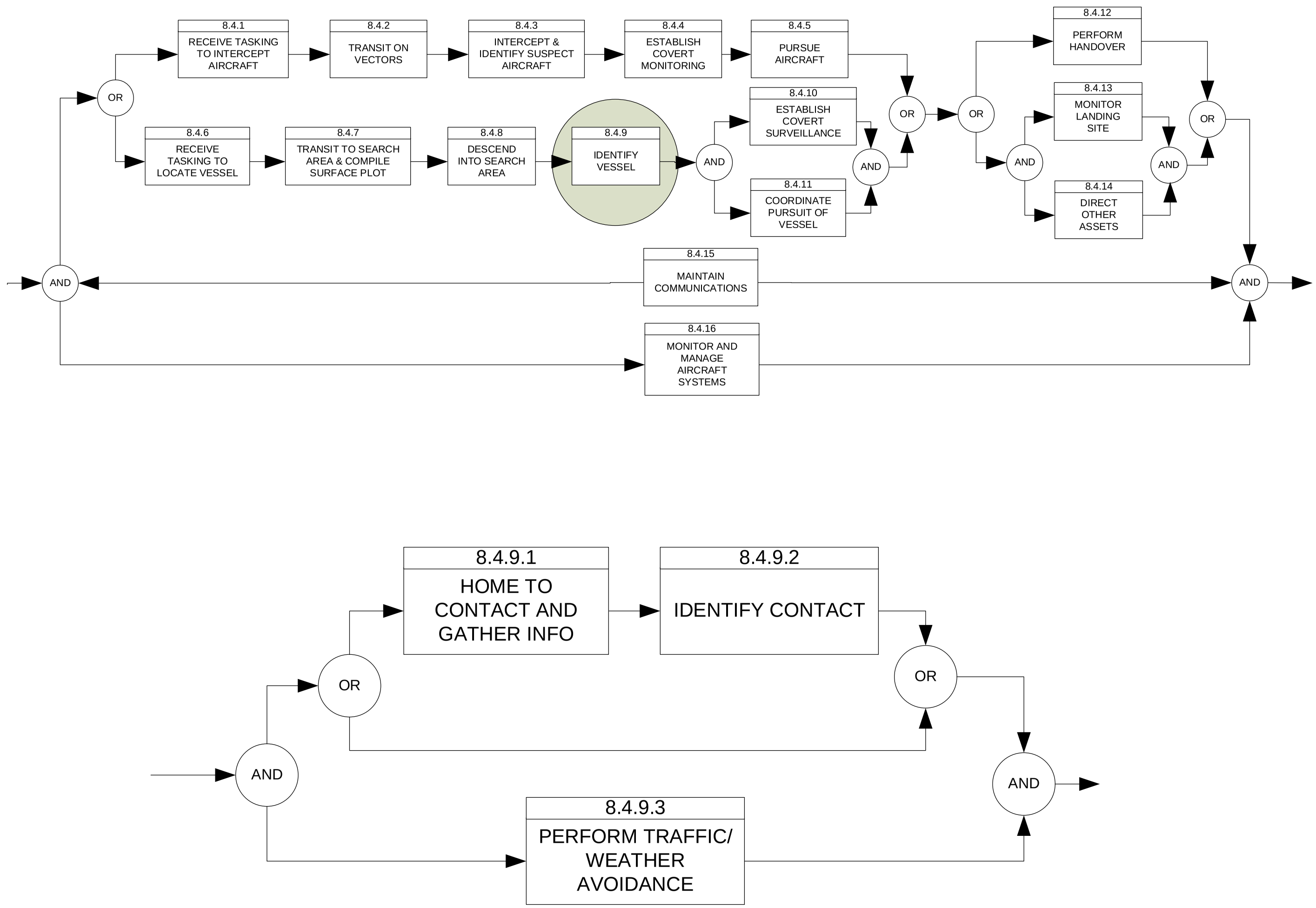


SEGMENT 8.4.3 – Intercept and Identify Suspect Aircraft

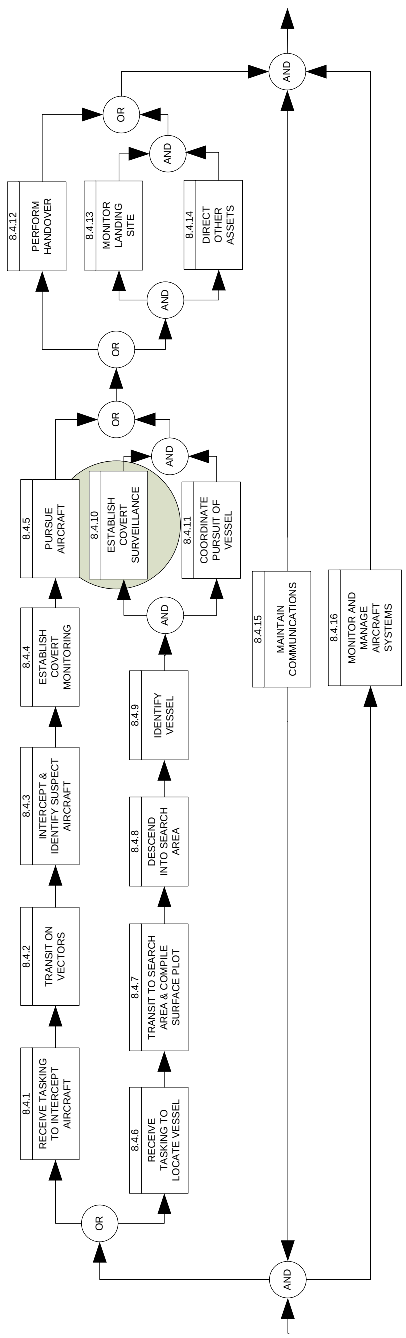


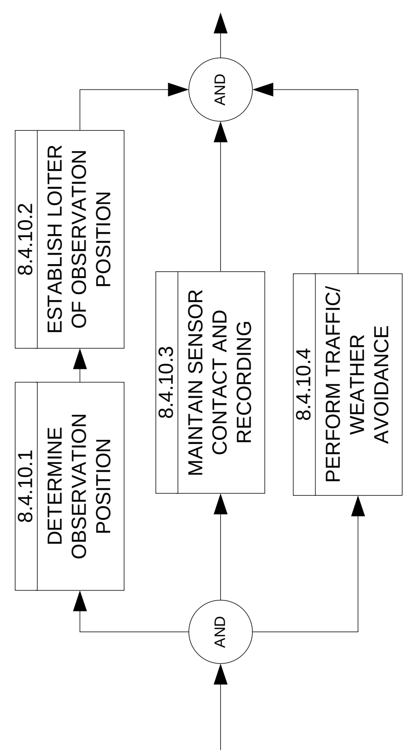


SEGMENT 8.4.5 – Pursue Aircraft

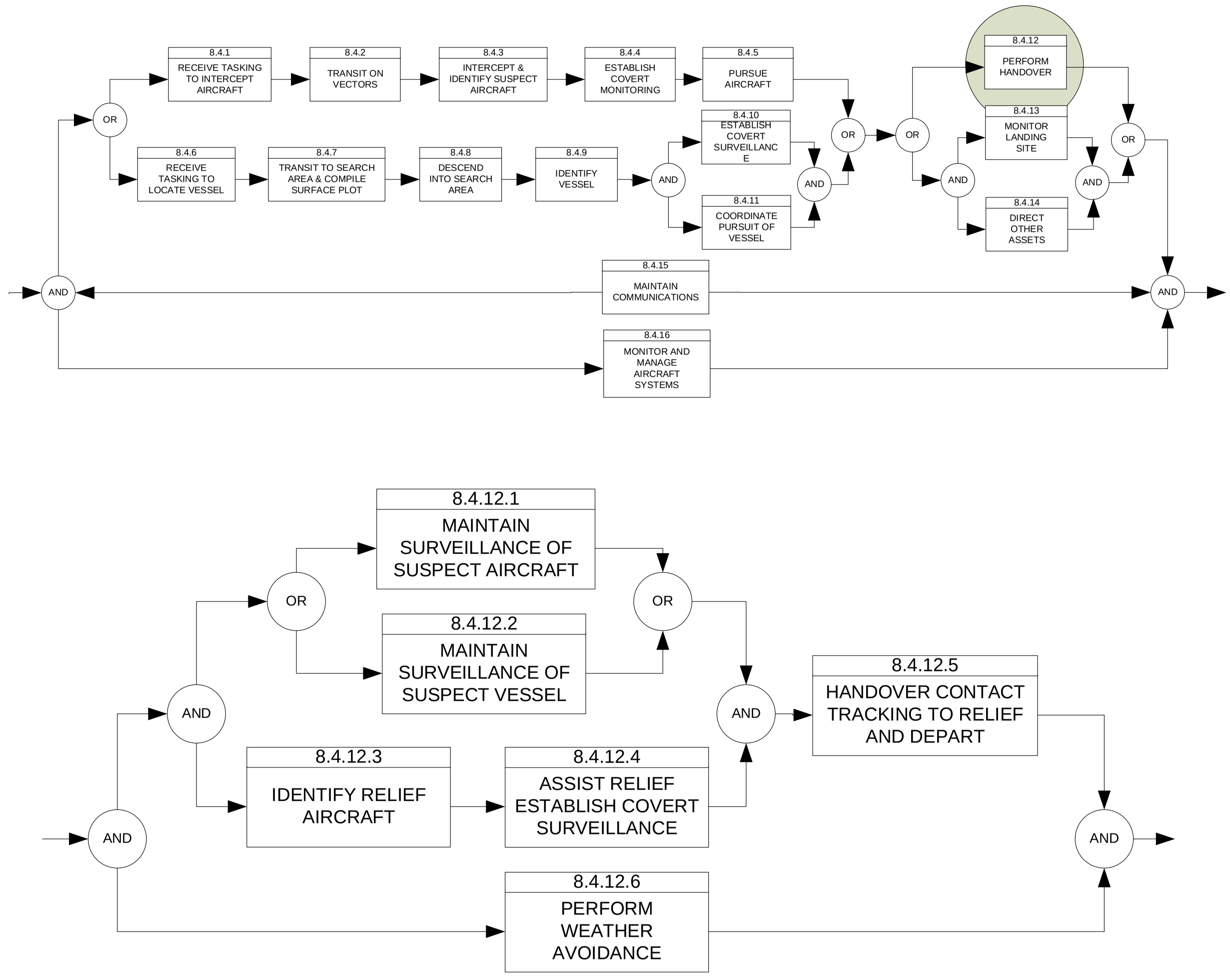


***SEGMENT 8.4.9* – Identify Vessel**

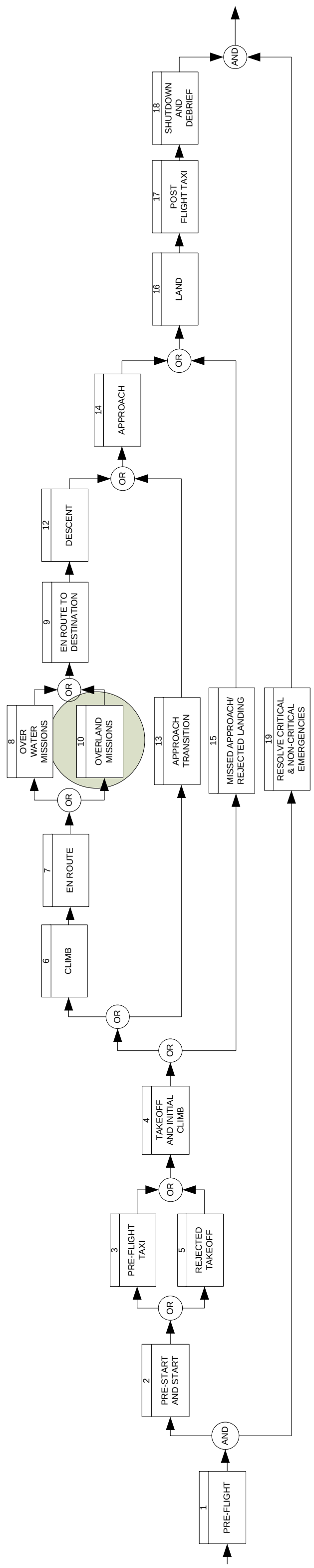


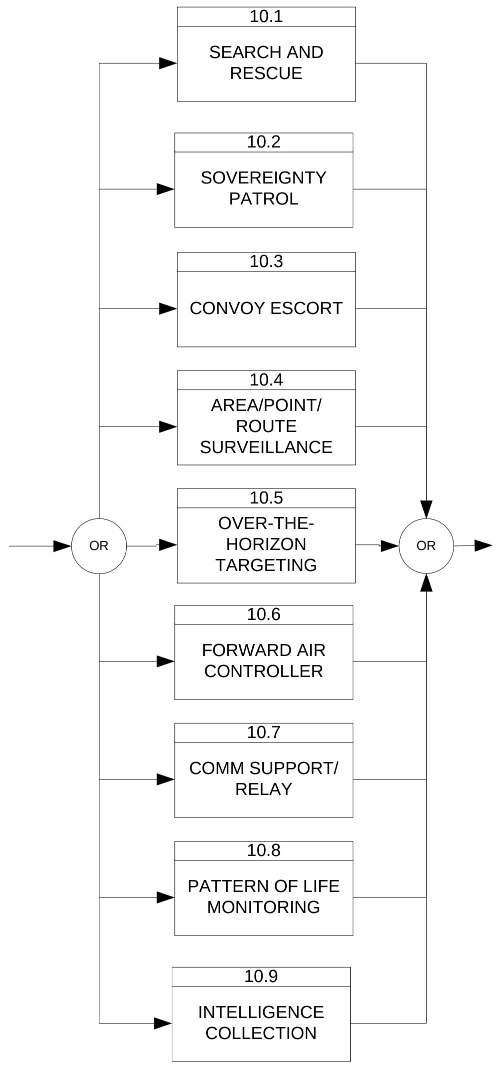


SEGMENT 8.4.10 – Establish Covert Surveillance

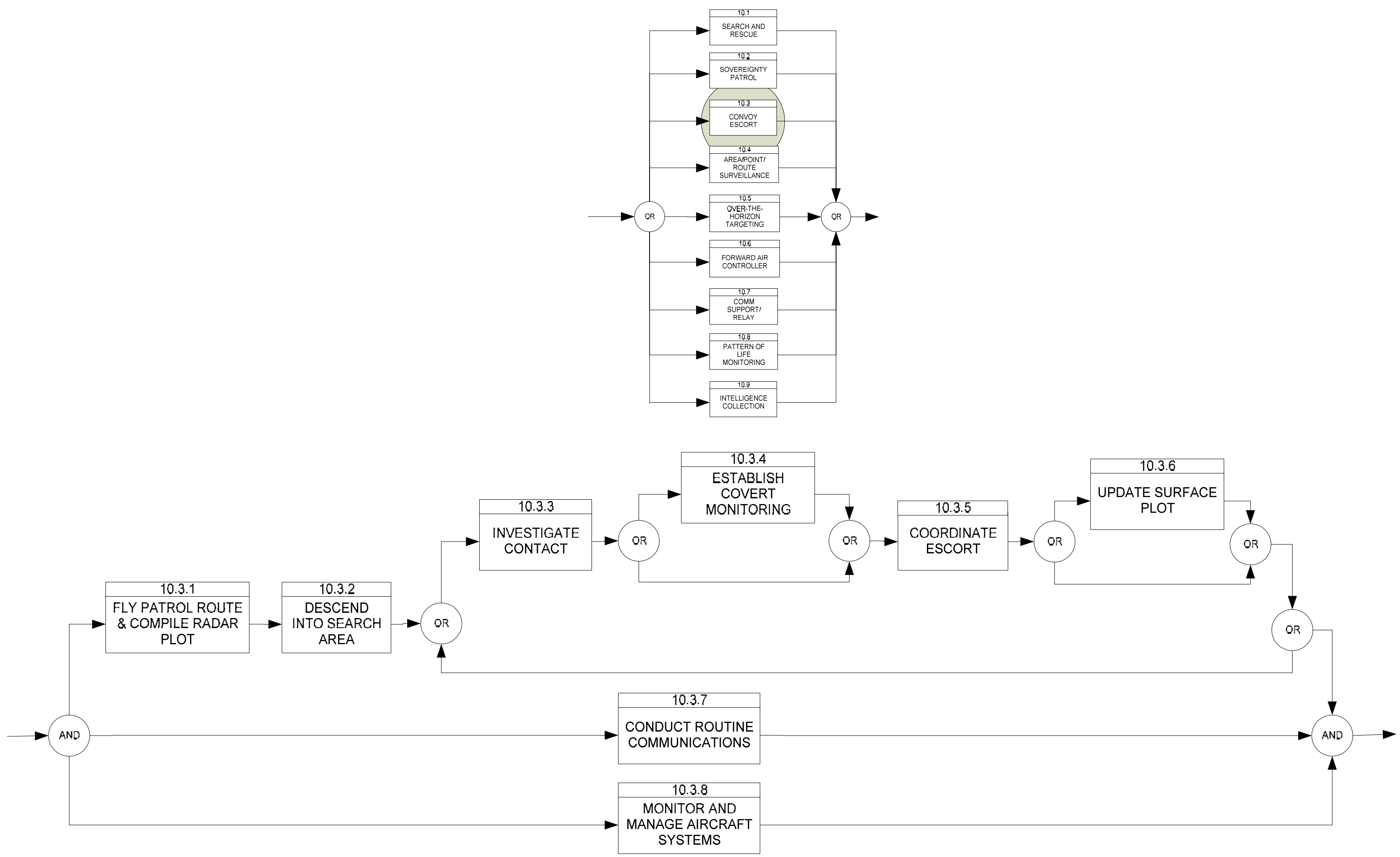


SEGMENT 8.4.12 – Perform Handover

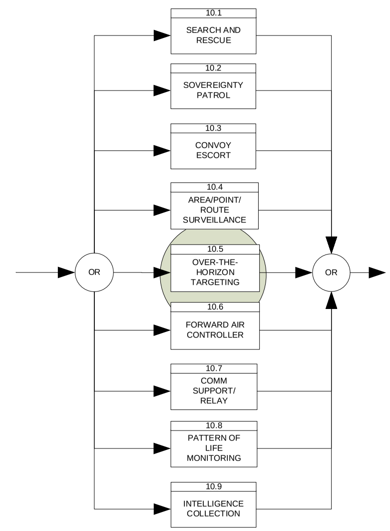


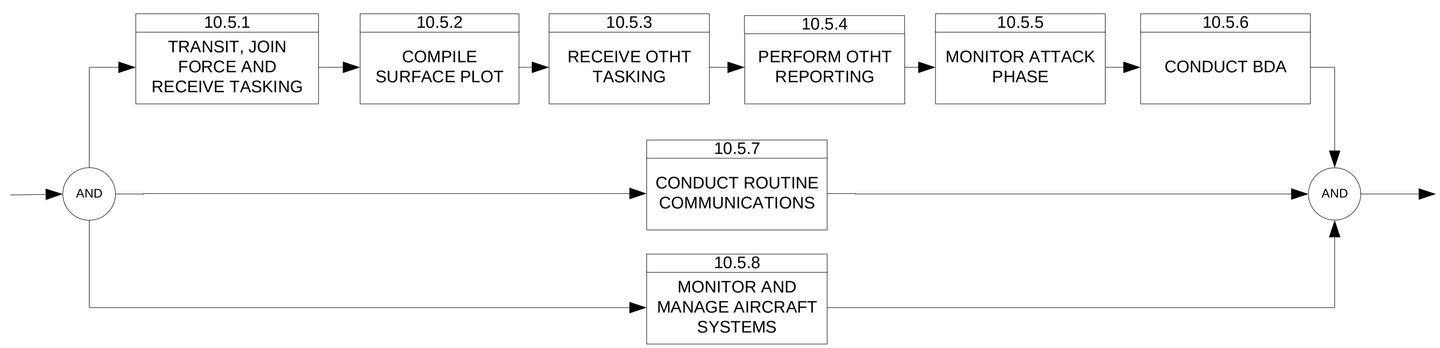


SEGMENT 10 – Overland Missions



SEGMENT 10.3 – Convoy Escort





SEGMENT 10.5 – Over-the-Horizon Targeting

Annex D Task Analysis Results

D.1 General

The following tasks are specific to the direct and indirect operation of the AIMS system by crew aboard the FWSAR and CP-140 AIMP aircrafts. Separate task analysis data sheets are provided for each of the individual tasks.

1 Pre- and Post-Flight Tasks

1.1 Select System AC Power On

1.2 Select System DC Power On

1.3 Verify Switch Settings

1.4 Select System Status Information

1.5 Check Parameter Settings

1.6 Adjust Parameter Settings

1.7 Note System Ready Indications

1.8 Conduct System Functional Checks

1.9 Confirm appropriate graphics available

1.10 Note IR Image Available

1.11 Check Video and Audio Recording

1.12 Deselect System Status Information

1.13 Select System Power Off

2 Illuminator Control Tasks

2.1 Illuminator Status Controls

2.1.1 Select Laser Active

2.1.2 Select Laser Passive

2.1.3 Select Laser Active Sub-mode – Continuous

2.1.4 Select Laser Active Sub-mode – Gated

2.1.5 Arm Laser Illuminator

2.1.6 De-Arm Laser Illuminator

2.1.7 Note Illuminator Status Indicator

2.1.8 Adjust Illuminator Power Level

2.1.9 Note Illuminator Power Level

2.2 Range Controls

2.2.1 Select Automatic Range Control

2.2.2 Select Manual Range Control

2.2.3 Note Illuminator Range

2.2.4 Adjust Range Manually

2.3 Range Gate Depth Controls

2.3.1 Note Range Gate Depth

2.3.2 Adjust Range Gate Depth Manually

2.4 Illuminator Divergence Controls

2.4.1 Select Illuminator Divergence

2.4.2 Note Illuminator Divergence

2.5 Pulse Width Controls

2.5.1 Select Pulse Width

2.5.2 Note Pulse Width

2.6 Repetition Rate Controls

2.6.1 Select Repetition Rate

2.6.2 Note Repetition Rate

3 Camera and Lens Control Tasks

3.1 Select Primary Sensor

3.2 Focus Controls

3.2.1 Observe Image Out-Of-Focus

3.2.2 Initiate Automatic Focus Control

3.2.3 Deactivate Automatic Focue Control

3.2.4 Adjust Focus Manually

3.3 FOV Controls

3.3.1 Note Additional Object Detail Required

3.3.2 Note Larger Camera FOV Required

3.3.3 Adjust FOV/Zoom

3.3.4 Note FOV Status Indication

- 3.4 Gain Controls
    - 3.4.1 Select Automatic Gain Control
    - 3.4.2 Select Manual Gain Control
    - 3.4.3 Adjust Gain Manually
    - 3.4.4 Note Gain Status Indicator
- 3.5 Electronic Zoom Controls
    - 3.5.1 Activate Electronic Zoom
    - 3.5.2 Deactivate Electronic Zoom
    - 3.5.3 Set Magnification Factor
    - 3.5.4 Note Electronic Zoom Indicator
- 3.6 IR Polarity Controls
    - 3.6.1 Select IR Polarity
    - 3.6.2 Note IR Image Polarity
- 3.7 Filter Controls
    - 3.7.1 Select Filter On
    - 3.7.2 Select Filter Off
    - 3.7.3 Note Filter Status Indicator
- 3.8 Iris Setting Controls
    - 3.8.1 Adjust Iris Setting Width
    - 3.8.2 Note Iris Setting

4 Steering Control Tasks

- 4.1 Vehicle Slave Mode Controls
    - 4.1.1 Select Vehicle Slave Set
    - 4.1.2 Select Vehicle Slave Mode
    - 4.1.3 De-Select Vehicle Slave Mode
    - 4.1.4 Note Vehicle Slave Status Indicator
- 4.2 Mode of Operation
    - 4.2.1 Manual Mode Controls
        - 4.2.1.1 Adjust Pan/Tilt Sensitivity
        - 4.2.1.2 Adjust Pan Angle

4.2.1.3 Adjust Tilt Angle

4.2.1.4 Slew Turret to Centre Contact on Display

4.2.2 Auto-Scan Controls

4.2.2.1 Initiate Automatic Scanning Mode

4.2.2.2 Terminate Automatic Scanning Mode

4.2.3 Mosaic Mode Controls

4.2.3.1 Enter Mosaic Sweep Parameters

4.2.3.2 Initiate Mosaic Mode

4.2.3.3 Terminate Mosaic Mode

4.2.3.4 Resume Mosaic Mode

5 Monitor and Manage System

5.1 Detect Platform Drift

5.2 Null Platform Drift

5.3 Monitor Status of AIMS Display

5.4 Monitor Status of Laser Illuminator

5.5 Monitor Status of Video Recorder

5.6 Replace Tape in the Video Recorder

5.7 Adjust CRT Display Characteristics

5.8 Adjust System Maintenance Controls

6 Pre-search tasks

6.1 Discuss Weather Predicted for Area

6.2 Review Known Features of Search Object

6.3 Review Terrain in Search Area

6.4 Evaluate Expected Sensor Performance in Area

6.5 Report Expected Sensor Performance

6.6 Develop Initial Search Plan

6.7 Determine Subsequent Search Plan

6.8 Report AIMS System Serviceability

6.9 Update System Parameters for Search

6.10 Conduct Pre-Search Briefing

6.11 Configure Moving Map Display

7 Search Tasks

7.1 Receive Report of Actual Weather Conditions from Flight Deck Crew

7.2 Observe Local Weather Conditions on AIMS Display

7.3 Compare Actual and Forecast Weather Conditions

7.4 Determine Actual Sensor Performance in Area

7.5 Monitor AIMS Display for Search Object

7.6 Initiate/Deactivate Auto-cueing Function

7.7 Maintain a Record of Sensor Coverage of Area

7.8 Receive Report of Radar or Visual Contact

7.9 Slew Turret to Radar or Visual Contact

7.10 Set AIMS Auto-Scan Parameters

7.11 Re-Initiate Search at Previously-Designated Position

8 Detection Tasks

8.1 Designate Targets

8.2 Capture Single Frame Imagery

8.3 Begin Recording AIMS Images

8.4 Report Status of Video Recording

8.5 Detect Contact on AIMS Display

8.6 Report AIMS Detection

8.7 Initiate a Contact File

8.8 Terminate Recording AIMS Images

9 Tracking Tasks

9.1 Track AIMS Contact Manually

9.2 Adjust Tracking Mode Parameters

9.3 Geo-Tracking (AUTO POINT) Mode Controls

9.3.1 Initiate Geo-Tracking (AUTO POINT) mode

9.4 Auto Track Mode Controls

9.4.1 Initiate AIMS Automatic Tracking

9.4.2 Adjust AIMS Automatic Tracking Manually

9.4.3 Report AIMS Automatic Tracking

9.4.4 Monitor the Accuracy of the Automatic Tracking Function

9.4.5 Advise Pilot of the Status of the AIMS Tracking Function

10 Classification and Identification Tasks

10.1 Monitor Contact on AIMS Display

10.2 Identify AIMS Contact

10.3 Report Contact Identification

10.4 Determine Range and Bearing to Contact

10.5 Report Range and Bearing to Contact

10.6 Monitor Estimated Range to Contact

10.7 Mark Index on Recording

10.8 Playback Video Imagery

10.9 Review Still Frame Imagery

10.10 Decide if the Detected Contact is the Object of the Search

10.11 Report if Contact is (or is not) the Search Object

10.12 Annotate Sensor Contact File

10.13 Evaluate Area Coverage

10.14 Terminate Video Playback

11 Rescue Site Evaluation

11.1 Determine Nature of Local Terrain on AIMS Display

11.2 Assess Hazards in Area

11.3 Maintain Situational Awareness Using Displays

11.4 Report Terrain Features

12 Return Transit Tasks

12.1 Receive Direction to Conduct Off Task Checks

12.2 Unload AIMS Recorder

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select System AC Power On

Task Description: Upon verifying the switch settings are in their correct position, the operator applies AC power to the AIMS system by activating the System AC Power On function on the operator control panel. The operator visually verifies that the display is updated as expected, and the System AC Power On indicator is illuminated. The power switch must be guarded against accidental activation. During cold start up, there is a 10 min warm-up time. In these situations, the operator will be presented with feedback indicating the delay in the warm-up process.

Task Completion Times:

2-5 sec - Very infrequent

Initiating Conditions:

1. Aircraft power has stabilized
2. There is a requirement to use the AIMS system
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Checklist/equipment operating procedures

   - Textual (alphanumeric)

2. Standard Operating Procedures

   - Textual (alphanumeric)

3.

4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

   - Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select System DC Power On

Task Description: The operator applies DC power to the AIMS system by activating the System DC Power On function. The operator visually verifies that the System DC Power On indicator is illuminated. The power switch must be guarded against accidental activation.

Task Completion Times:

2-5 sec - Very infrequent

Initiating Conditions:

1. Aircraft power has stabilized

2. There is a requirement to use the AIMS system

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Checklist/equipment operating procedures

- Textual (alphanumeric)

2. Standard Operating Procedures

- Textual (alphanumeric)

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Verify Switch Settings

Task Description: The operator visually inspects the AIMS control panel to verify that all switch settings are in the correct position. During the performance of the task, the operator makes a decision as to whether any switch positions need to be changed. This activity would normally be completed prior to applying power to the system, although it could also be conducted at other times (e.g. immediately prior to enabling the laser illuminator). The operator may refer to Standard Operating Procedures or checklists during the performance of this task.

Task Completion Times:

5-10 sec - Very infrequent

Initiating Conditions:

1. The AIMS system is being configured for use
2.
3.

Decision Required:

Decisional Rating Four: This task has a significant decisional component that overshadows the other cognitive content.

Information Required:

1. Checklist/equipment operating procedures

   - Textual (alphanumeric)

2. Standard Operating Procedures

   - Textual (alphanumeric)

3. Correct parameter settings

   - Memory

4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. None

   - Not applicable

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select System Status Information

Task Description: In preparation for checking the current status of the AIMS system, the operator selects the function which causes system status information to be displayed. The operator visually verifies that the information is displayed as expected. Presentation of the system status information may be done automatically to the operator upon power up. More detailed system status information may also be accessible to support a technician.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. The AIMS system has been configured for use
2. There is a need to verify system status selections
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Check Parameter Settings

Task Description: The operator visually inspects all relevant system parameter settings for consistency with the mission objectives. During the performance of the task, the operator makes a decision as to whether any parameter settings need to be changed. This decision is based primarily on the anticipated environmental conditions and the likelihood of the search object being a cooperative target. Since the operator is able to make the changes while viewing the system status information, there is no need to make notes for future reference.

Task Completion Times:

10-30 sec - Frequent

Initiating Conditions:

1. There is a need to verify that parameter settings are appropriate for the mission

2.

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Anticipated environmental conditions in the area

- Combination textual/graphical

2. Checklist/equipment operating procedures

- Textual (alphanumeric)

3. Correct parameter settings

- Memory

4. Mission requirements and objectives

- Combination textual/graphical; Memory

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Parameter Settings

Task Description: Having made a decision on the system parameter settings that need to be changed, the operator makes the adjustments via the operator control panel. This task is accomplished while also viewing the system status information. The operator visually verifies that the parameter is adjusted as desired.

Task Completion Times:

5-60 sec - Frequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2.
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. Correct parameter settings

   - Memory
2.
3.
4.

Action Required:

1. Adjust parameter selection

   - Fixed/programmable function key

   - Rotary control (continuous or discrete)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

   - Visual message/alert
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note System Ready Indications

Task Description: The operator verifies that the AIMS system is ready for operation. This includes confirming that power is applied and, if applicable, the laser illuminator is armed. The operator makes a mental note of any actions required to make the system ready for use.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. Power has been applied to the system

2. The laser is armed (if applicable for the light conditions)

3. The gyro spin-up is complete

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2.

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Conduct System Functional Checks

Task Description: The operator conducts a series of functional checks to ensure the system is operational and configured as required to accomplish mission objectives. This activity includes verifying proper operation of functions such as Pan, Tilt, Focus, Zoom, Filter and Gain (contrast) as well as conducting calibration checks. While activating each function, the operator verifies that the display imagery and system status indicators function as anticipated. The operator normally refers to a checklist during the performance of this task. Self-initiated built-in tests may also be conducted by the system with results accessible to the operator/maintainer.

Task Completion Times:

60-120 sec - Very infrequent

Initiating Conditions:

1. The AIMS system is ready for operation

2.

3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. Checklist/equipment operating procedures

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2. Read and interpret information

- Mental processing activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Confirm appropriate graphics available

Task Description: The operator views display and confirms that all required graphics are displayed. If required graphics are not there or if non-required graphics are visible the operator will select the appropriate graphics for display.

Task Completion Times:

5 - 10 sec - Very Infrequent

Initiating Conditions:

1. IR display has been selected.
2. The operator is conducting preflight.
3.

Decision Required:

Decisional Rating Four: This task has a significant decisional component that overshadows the other cognitive content.

Information Required:

1. Checklist/Operating procedures
2. Standard operating procedures

   - Memory
3.
4.

Action Required:

1. Perform visual inspection

   - Visual activity
2.
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2. Visual indication of equipment status
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note IR Image Available

Task Description: Operator confirms that the IR image is available after between 8 to 10 minutes cool down. The AIMS system remains operable while the IR system is cooling down.

Task Completion Times:

2-3 secs - Very Infrequent

Initiating Conditions:

1. IR is being configured for use

2. The operator is conducting preflight

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component with only insignificant decisional aspects to any cognitive content.

Information Required:

1. Checklist/Operating procedures

2. Standard operating procedures

- Memory

3.

4.

Action Required:

1. Perform visual inspection

- Visual activity

2.

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2. Visual indication of equipment status

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Check Video and Audio Recording

Task Description: The operator conducts a series of checks to ensure the AIMS video and audio recorder is operational and functioning as expected. This activity consists of recording a short video segment, inserting a test voice annotation, and replaying the tape to ensure proper operation of the recording and playback functions (including time code information). The operator verifies proper operation both visually and aurally, making either mental or written notes of deficiencies as required for future reference. The operator normally refers to a checklist during the performance of this task.

Task Completion Times:

120-180 sec - Very infrequent

Initiating Conditions:

1. A tape has been loaded in the video recorder

2. The mission requires video recording

3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. Checklist/equipment operating procedures

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Listen and interpret information

- Mental processing activity

2. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

- Visual activity

4. Read and interpret information

- Mental processing activity

Feedback Required:

1. Aural response

- Auditory

2. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

3. Appropriate information appears on the display

- Visual state change

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Deselect System Status Information

Task Description: Having verified that the system is configured as desired, the operator de-selects the system status information from the display. The operator visually verifies that the status information is no longer displayed.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. System status information is no longer required
2.
3.

Decision Required:

Decisional Rating Ten: This task includes a visual, auditory, or psychomotor component, with no decisional aspects to any cognitive content.

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select System Power Off

Task Description: The operator removes both AC and DC power from the AIMS system by activating the System Power Off function on the operator control panel. The operator visually verifies that the display is cleared as expected, and the System Power On indicator is no longer illuminated.

Task Completion Times:

2-5 sec - Very infrequent

Initiating Conditions:

1. The AIMS system is no longer required
2.
3.

Decision Required:

Decisional Rating Ten: This task includes a visual, auditory, or psychomotor component, with no decisional aspects to any cognitive content.

Information Required:

1. Checklist/equipment operating procedures

   - Textual (alphanumeric)

2. Standard Operating Procedures

   - Textual (alphanumeric)

3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Laser Active

Task Description: The operator selects the Laser Active mode on the control panel, which causes the illuminator to operational. The operator verifies that the illuminator is operating as anticipated.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. Light conditions require use of the laser illuminator
2. The AIMS system has been armed
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

   - Visual message/alert
2. Visual indication of equipment status

   - Indicator light (on/off)
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Laser Passive

Task Description: The operator selects the Laser Passive mode on the control panel, which causes the illuminator to cease operating. In this mode, the Gate and Range functions have no affect on the video image. The operator verifies that the illuminator is no longer operating, and that the video imagery is updated as expected.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. Light conditions no longer require use of the laser illuminator
2. The AIMS system has been armed
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None
   - Not applicable
2.
3.
4.

Action Required:

1. Make switch or function selection
   - Fixed/programmable function key
   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function
   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display
   - Visual state change
2. Visual indication of equipment status
   - Indicator light (on/off)
   - Visual message/alert
3.

Task: Select Laser Active Sub-mode - Continuous

Task Description: If the operator selects the Laser Active mode on the control panel, the operator then selects the Continuous sub-mode which does not invoke the active gated functionality. The active gated functionality will not be accessible in this sub-mode. This sub-mode may be used for clear nights without any cloud, rain, snow, etc.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. The laser illuminator has been armed
2. The laser illuminator has been set to active
3. Light conditions require the use of the laser illuminator

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2. Visual indication of equipment change

   - Indicator light (on/off)

   - Visual message/alert
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Laser Active Sub-mode - Gated

Task Description: If the operator selects the Laser Active mode on the control panel, the operator then selects the Gated sub-mode which causes the illuminator to operate in synchronization with the camera gating signals. The active gated functionality will be accessible in this sub-mode.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. The laser illuminator has been armed
2. The laser illuminator has been set to active
3. Light conditions require the use of the laser illuminator

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

   - Not applicable

2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment change

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Arm Laser Illuminator

Task Description: The operator arms the laser illuminator by selecting the Laser Arm function on the operator control panel. This enables the laser illuminator for operation. The operator visually verifies that the Laser Armed indicator is illuminated. The design of the operator control panel incorporates safeguards to prevent inadvertent arming of the laser illuminator system.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. Light conditions may require use of the laser illuminator

2. The AIMS system is ready for operation

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: De-Arm Laser Illuminator

Task Description: The operator de-arms the laser illuminator by selecting the Laser Safe function on the operator control panel. This configures the system in a safe mode to prevent external illumination. The operator visually verifies that the Laser Armed indicator is no longer illuminated.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. Light conditions no longer require use of the laser illuminator; or
2. The AIMS system is no longer required
3. The laser illuminator is armed

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

   - Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

   - Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Illuminator Status Indicator

Task Description: The operator visually checks the status of the laser illuminator. This task is conducted periodically throughout the mission for situational awareness and to confirm the status of the arming and active/passive functions. The operator makes a decision as to whether any action is required to change the status of the laser illuminator.

Task Completion Times:

3-6 sec - Very frequent

Initiating Conditions:

1. The AIMS system is in use

2.

3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Illuminator Power Level

Task Description: The operator selects the power level for the laser illuminator as required for the current mission objectives.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2. The laser illuminator is armed and active
3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Mission requirements and objectives
   - Combination textual/graphical
   - Memory
2.
3.
4.

Action Required:

1. Make switch or function selection
   - Fixed/programmable function key
   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function
   - Visual activity
3.
4.

Feedback Required:

1. Visual indication of equipment status
   - Indicator light (on/off)
   - Visual message/alert
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Illuminator Power Level

Task Description: The operator visually checks the power level of the laser illuminator. This task is conducted periodically throughout the mission. The operator makes a decision as to whether any action is required to change the power level of the laser illuminator.

Task Completion Times:

2-5 sec - Infrequent

Initiating Conditions:

1. The laser illuminator is armed and active

2.

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Automatic Range Control

Task Description: The operator activates the Automatic Range Control Mode by selecting Auto-Range on the control panel. The operator verifies that the manual range control function is no longer available, and that the Illumination Range updates in response to changes in the distance to the target. The Auto-Range control function is only available when the laser illuminator is in the Active Mode.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. The laser illuminator is armed and active

2. Use of automatic range control would be appropriate for the mission

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. Mission requirements and objectives

- Combination textual/graphical

- Memory

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Manual Range Control

Task Description: The operator activates the Manual Range Control Mode by selecting Manual Range on the control panel. The operator verifies that the manual range control function becomes operable, and that the Illumination Range updates in response to adjustments to it. The Manual Range control function is only available when the laser illuminator is in the Active Mode.

Task Completion Times:

5-7 sec - Infrequent

Initiating Conditions:

1. The laser illuminator is armed and active
2. The current setting(s) are not appropriate for the mission
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Illuminator Range

Task Description: The operator visually checks the Illuminator Range to ensure it is as anticipated. This task is performed periodically while in Laser Active Mode, with either automatic or manual range control selected. The operator mentally evaluates the illumination range for consistency with the display imagery, and makes a decision as to whether the current configuration for range control is appropriate.

Task Completion Times:

10-15 sec - Very frequent

Initiating Conditions:

1. The laser illuminator is armed and active

2. The illuminator is in either automatic or manual range control mode

3.

Decision Required:

Decisional Rating Four: This task has a significant decisional component that overshadows the other cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Range Manually

Task Description: The operator uses the manual range control function on the control panel to adjust the range of the camera gate (i.e. the slant range to the closest point of the area to be illuminated).While performing this task, the operator refers to the camera imagery to obtain estimates of the range to the target. The operator verifies that the range setting and the video imagery are updated as expected. The operator may refer to Standard Operating Procedures for guidance in determining the optimum value for specific missions, flight profiles and environmental conditions. This task may be performed in either Laser Active or Passive Modes, although there will be no effect on the imagery in the Passive Mode.

Task Completion Times:

5-15 sec - Very frequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2. The laser illuminator is armed and active
3. The laser illuminator is in the manual range control mode

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

   - Not applicable

2.

3.

4.

Action Required:

1. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Perform visual inspection or monitoring function

   - Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual message/alert

   - Visual state change

2. Tactile feedback

   - Tactile

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Range Gate Depth

Task Description: The operator visually checks the current setting for the camera gate depth, and makes a decision as to whether the current value is appropriate for the current mission. The operator may refer to Standard Operating Procedures for guidance in determining the optimum value for specific missions, flight profiles and environmental conditions. This task may be performed in either Laser Active or Passive Modes.

Task Completion Times:

10-30 sec - Very frequent

Initiating Conditions:

1. The laser illuminator is in either active or passive mode
2. The laser illuminator is armed
3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. Standard Operating Procedures

   - Textual (alphanumeric)
2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity
2. Perform visual inspection or monitoring function

   - Visual activity
3. Read and interpret information

   - Mental processing activity
4.

Feedback Required:

1. None

   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Range Gate Depth Manually

Task Description: The operator uses the Gate Depth function on the control panel to adjust the camera gate depth. The operator verifies that the current gate depth setting and the video imagery are updated as expected. The operator may refer to Standard Operating Procedures for guidance in determining the optimum value for specific missions, flight profiles and environmental conditions. This task may be performed in either Laser Active or Passive Modes, although there will be no effect on the imagery in the Passive Mode.

Task Completion Times:

10-30 sec - Very frequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission

2. The laser illuminator is armed

3. The laser illuminator is in either active or passive mode

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Standard Operating Procedures

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual message/alert

- Visual state change

2. Tactile feedback

- Tactile

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Illuminator Divergence

Task Description: The operator selects either Wide or Narrow Divergence for the laser illuminator as required for the current mission objectives. This is accomplished by activating the Divergence Select function and verifying that the correct selection is implemented.

Task Completion Times:

5-7 sec - Frequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2. The laser illuminator is armed and active
3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Mission requirements and objectives
   - Combination textual/graphical
   - Memory
2.
3.
4.

Action Required:

1. Make switch or function selection
   - Fixed/programmable function key
   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function
   - Visual activity
3.
4.

Feedback Required:

1. Visual indication of equipment status
   - Indicator light
   - Visual message/alert
2. Tactile feedback
   - Tactile
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Illuminator Divergence

Task Description: The operator visually checks whether the laser illuminator is selected to Wide or Narrow Divergence. This task is conducted periodically throughout the mission to ensure quality imagery is obtained. The operator makes a decision as to whether the current selection is correct.

Task Completion Times:

2-5 sec - Frequent

Initiating Conditions:

1. The laser illuminator is armed and active

2.

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Pulse Width

Task Description: The operator selects the pulse width for the laser illuminator as required for the current mission objectives. This is accomplished by activating the Pulse Width function and verifying that the correct selection is implemented.

Task Completion Times:

5-10 sec - Frequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission

2. The laser illuminator is armed

3. The laser illuminator is in either active or passive mode

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Standard Operating Procedures

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual message/alert

- Visual state change

2. Tactile feedback

- Tactile

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Pulse Width

Task Description: The operator visually checks the pulse width of the laser illuminator. This task is conducted periodically throughout the mission to ensure quality imagery is obtained. The operator makes a decision as to whether the current selection is correct.

Task Completion Times:

10-30 sec - Frequent

Initiating Conditions:

1. The laser illuminator is in either active or passive mode

2. The laser illuminator is armed

3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. Standard Operating Procedures

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3. Read and interpret information

- Mental processing activity

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Repetition Rate

Task Description: The operator selects the repetition rate for the laser illuminator as required for the current mission objectives. This is accomplished by activating the Repetition Rate function and verifying that the correct selection is implemented.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2. The laser illuminator is armed and active
3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Mission requirements and objectives
   - Combination textual/graphical
   - Memory
2.
3.
4.

Action Required:

1. Make switch or function selection
   - Fixed/programmable function key
   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function
   - Visual activity
3.
4.

Feedback Required:

1. Visual indication of equipment status
   - Indicator light (on/off)
   - Visual message/alert
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Repetition Rate

Task Description: The operator visually checks the repetition rate of the laser illuminator. This task is conducted periodically throughout the mission to ensure quality imagery is obtained. The operator makes a decision as to whether the current selection is correct.

Task Completion Times:

2-5 sec - Infrequent

Initiating Conditions:

1. The laser illuminator is armed and active

2.

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Primary Sensor

Task Description: The primary display area shows multiple sensor windows simultaneously. The operator chooses which is to be considered primary. The sensor image window for the primary sensor is given visual priority. The primary sensor setting is also critical to common functions, such as auto-track. When the auto-track function is selected, the auto-track on/off command is sent to the primary sensor. Selection of the primary sensor depends on factors such as the environmental conditions and the target type.

Task Completion Times:

1-2 sec - Very Frequent

Initiating Conditions:

1. Aircraft power is stabilized.

2. The operator is conducting preflight.

3.

Decision Required:

Decisional Rating Ten: This task includes a visual, auditory, or psychomotor component, with no decisional aspects to any cognitive component.

Information Required:

1. Checklist/Operating procedures

2. Standard operating procedures

- Memory

3.

4.

Action Required:

1. Make switch or function selection

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Observe Image Out-Of-Focus

Task Description: While monitoring the display, the operator observes that the image is out of focus. A decision is made that the quality of the image can be improved.

Task Completion Times:

5-10 sec - Very frequent

Initiating Conditions:

1. The current setting(s) are not appropriate.

2.

3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2.

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Initiate Automatic Focus Control

Task Description: The operator activates the Automatic Focus Control Mode by selecting Auto-Focus on the control panel. The operator monitors the quality of the display image during the performance of the task to obtain the optimum setting. The operate may need to manually fine-tune the focus in order to achieve an image that is as clear and sharp as possible.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. The display focus requires adjustment.

2. Use of automatic focus control would be appropriate for the mission

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3. Tactile feedback

- Tactile

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Deactivate Automatic Focus Control

Task Description: The operator de-selects the Auto-Focus function on the control panel to deactivate it.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. The display focus requires adjustment.

2. Use of automatic focus control would be appropriate for the mission

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3. Tactile feedback

- Tactile

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Focus Manually

Task Description: The operator adjusts the display focus to achieve an image that is as clear and sharp as possible. This is accomplished by manually adjusting the Focus control on the operator control panel. The operator monitors the quality of the display image during the performance of the task to obtain the optimum setting.

Task Completion Times:

5-15 sec - Very frequent

Initiating Conditions:

1. The display focus requires adjustment
2.
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2. Tactile feedback

   - Tactile
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Additional Object Detail Required

Task Description: While visually monitoring display imagery, the operator observes that additional detail is required to clarify the characteristics of the return from a particular geographical position. This activity is normally associated with the task of classifying or identifying a particular contact. A decision is made as to how best to obtain the additional detail.

Task Completion Times:

5-10 sec - Frequent

Initiating Conditions:

1. The operator is evaluating display imagery
2.
3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. None

   - Not applicable

2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. None

   - Not applicable

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Larger Camera FOV Required

Task Description: While visually monitoring display imagery, the operator observes that a wider camera field-of-view is required to accomplish mission objectives. This activity is normally associated with the function of conducting a wide-area search. The operator assesses the impact that a wider FOV would have on the ability to detect the object of the search, and makes a decision on the optimum FOV.

Task Completion Times:

5-10 sec - Frequent

Initiating Conditions:

1. The operator is monitoring display imagery

2. The current setting(s) are not appropriate for the mission

3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust FOV/Zoom

Task Description: The operator uses the Zoom control to adjust the magnification factor up or down to obtain the optimum field-of-view (FOV) and image resolution to accomplish specific mission objectives (e.g. to conduct a large-area search or to obtain details on an identified object). The operator monitors the imagery during the performance of this task, mentally evaluating the relative merits of the imagery as the zoom factor is adjusted. A decision is made on the optimum zoom factor to best achieve current mission objectives. The operator may refer to Standard Operating Procedures for guidance in configuring the camera for different missions, flight profiles and environmental conditions. When zooming in, the pan/tilt sensitivity are automatically adjusted to support operation of these functions

Task Completion Times:

5-15 sec - Very frequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2.
3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Standard Operating Procedures

   - Textual (alphanumeric)
2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity
2. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)
3. Perform visual inspection or monitoring function

   - Visual activity
4. Read and interpret information

   - Mental processing activity

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2. Tactile feedback

   - Tactile
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note FOV Status Indication

Task Description: The operator notes the current FOV setting for a given camera by reading the text information on the display.

Task Completion Times:

1-2 sec - Very Frequent

Initiating Conditions:

1. Primary camera is being configured for use.

2. The operator is conducting preflight

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive component.

Information Required:

1. Checklist/Operating procedures

2. Standard operating procedures

- Memory

3.

4.

Action Required:

1. Perform visual inspection

- Visual activity

2.

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

- Visual message

2. Textual and/or graphic indication

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Automatic Gain Control

Task Description: The operator configures the camera to automatically adjust the gain (i.e. contrast level) of the camera in response to existing environmental conditions, aircraft altitude and speed, and other camera settings (i.e. lens extender setting, zoom factor, etc.). This function will also automatically adjust the laser illuminator parameters (i.e. power level, pulse width, divergence) when the laser is set to Active Mode. This is accomplished by selecting Auto-Gain on the control panel. The operator evaluates the quality of the imagery and makes a decision as to whether mission objectives could be better accomplished with manual control.

Task Completion Times:

5-20 sec - Infrequent

Initiating Conditions:

1. The system is in the manual gain control mode
2. Use of automatic gain control would be appropriate for the mission
3.

Decision Required:

Decisional Rating Four: This task has a significant decisional component that overshadows the other cognitive content.

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity
2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)
3. Perform visual inspection or monitoring function

   - Visual activity
4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert
2. Appropriate information appears on the display

   - Visual state change
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Manual Gain Control

Task Description: The operator configures the camera for manual gain control (i.e. contrast level).This is accomplished by selecting Manual Gain on the control panel.

Task Completion Times:

5-7 sec - Infrequent

Initiating Conditions:

1. The system is in the automatic gain control mode
2. Use of manual gain control would be appropriate for the mission
3.

Decision Required:

Decisional Rating Ten: This task includes a visual, auditory, or psychomotor component, with no decisional aspects to any cognitive content.

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Gain Manually

Task Description: The operator uses the Gain function on the control panel to adjust the image contrast for maximum effectiveness. The operator monitors the display visually to verify that the contrast changes in response to control adjustments, and to achieve the optimum setting. The operator evaluates the quality of the imagery and makes a decision as to whether improved performance could be obtained with the Auto-Gain setting.

Task Completion Times:

5-45 sec - Frequent

Initiating Conditions:

1. The system is in the manual gain control mode

2. The current setting(s) are not appropriate for the mission

3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Perform visual inspection or monitoring function

- Visual activity

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2. Tactile feedback

- Tactile

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Gain Status Indicator

Task Description: The operator periodically checks the Gain Status Indicator to verify if the system is configured for automatic or manual gain control. A decision is made as to whether a change is required.

Task Completion Times:

5-7 sec - Infrequent

Initiating Conditions:

1. The AIMS system is in use
2.
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. None

   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Activate Electronic Zoom

Task Description: The operator selects the Electronic Zoom function on the control panel to activate the zoom to improve the quality of the imagery. The operator mentally compares the quality of the "before" and "after" images, and makes a decision as to which configuration offers the best performance with respect to mission objectives.

Task Completion Times:

2-3 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2.
3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content

Information Required:

1. Standard Operating Procedures

   - Textual (alphanumeric)

2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light

   - Visual message/alert

2. Appropriate information appears on the display

   - Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Deactivate Electronic Zoom

Task Description: The operator de-selects the Electronic Zoom function on the control panel to deactivate the zoom.

Task Completion Times:

2-3 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission

2.

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content

Information Required:

1. Standard Operating Procedures

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

- Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Set Magnification Factor

Task Description: The operator adjusts the magnification factor between 1x and 10x as required for the current mission objectives.

Task Completion Times:

2-3 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission

2.

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content

Information Required:

1. Standard Operating Procedures

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

- Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Electronic Zoom Indicator

Task Description: The operator notes the current electronic zoom setting for a given camera by reading the text information on the display.

Task Completion Times:

2-5 sec - Infrequent

Initiating Conditions:

1. The AIMS system is in use
2.
3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. None

   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select IR Polarity

Task Description: The operator toggles the IR camera polarity and confirms a reversal in gray scale of the IR scene.

Task Completion Times:

4-6 sec - Infrequent

Initiating Conditions:

1. Improved performance is expected with a change in IR polarity

2.

3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

2. Perform visual inspection

- Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2. Textual and/or graphical indication

- Visual message

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note IR Image Polarity

Task Description: The operator notes the current IR polarity setting for the IR camera by reading the text information on the display.

Task Completion Times:

2-5 sec - Infrequent

Initiating Conditions:

1. The AIMS system is in use
2.
3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

   - Not applicable

2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. None

   - Not applicable

2.
3.

Task: Select Filter On

Task Description: The operator selects the Filter On function on the control panel to activate the optical noise filter to improve the quality of the imagery. The operator mentally compares the quality of the "before" and "after" images, and makes a decision as to which configuration offers the best performance with respect to mission objectives.

Task Completion Times:

5-15 sec - Infrequent

Initiating Conditions:

1. Improved performance is expected with the filter On
2. The optical filter is selected Off
3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

   - Not applicable

2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Filter Off

Task Description: The operator selects the Filter Off function on the control panel to remove the optical noise filter. The operator mentally compares the quality of the "before" and "after" images, and makes a decision as to which configuration offers the best performance with respect to mission objectives.

Task Completion Times:

5-15 sec - Infrequent

Initiating Conditions:

1. Improved performance is expected with the filter Off
2. The optical filter is selected On
3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

   - Not applicable

2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

2. Appropriate information appears on the display

   - Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Filter Status Indicator

Task Description: The operator periodically checks the Filter Status Indicator to verify if optical noise filter is engaged or not. A decision is made as to whether a change is required.

Task Completion Times:

2-5 sec - Infrequent

Initiating Conditions:

1. The AIMS system is in use

2.

3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Iris Setting Width

Task Description: The operator selects the iris setting for a camera as required for the current mission objectives. This is accomplished by activating the Iris Setting function and verifying that the correct selection is implemented.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission

2.

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Mission requirements and objectives

- Combination textual/graphical

- Memory

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light

- Visual message/alert

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Note Iris Setting

Task Description: The operator visually checks the iris setting of the camera. This task is conducted periodically throughout the mission to ensure quality imagery is obtained. The operator makes a decision as to whether the current selection is correct.

Task Completion Times:

2-5 sec - Infrequent

Initiating Conditions:

1.

2.

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Vehicle Slave Set

Task Description: The operator defines a camera position relative to the aircraft (i.e. pan angle) by selecting the Slave Set function on the control panel. The operator verifies that the Slave Set entry has been accepted by the system.

Task Completion Times:

5-7 sec - Infrequent

Initiating Conditions:

1. The current slave set position is not appropriate for the mission
2. There is a need to slave the camera to a particular position relative to the aircraft
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Desired position for slaved camera relative to aircraft

   - Graphical

   - Textual (alphanumeric)

2. Relative orientation of aircraft and camera

   - Graphical

3.

4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

   - Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Select Vehicle Slave Mode

Task Description: The operator activates the vehicle-slaved mode of operation. This is accomplished by activating the Slave On function on the operator control panel. In this mode the camera returns to the slaved position anytime that joystick pressure is released. The operator verifies that the camera is slewed to the Slave Set position when joystick pressure is released, and that the Slave Status Indicator reflects the vehicle-slaved mode.

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. A slave set position has been selected

2. There is a need to slave the camera to a particular position relative to the aircraft

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Relative orientation of aircraft and camera

- Graphical

2. Slaved position set in the system

- Graphical

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: De-Select Vehicle Slave Mode

Task Description: The operator configures the camera in an unslaved mode by activating the Slave Off function on the operator control panel. The operator verifies that the Slave Status Indicator reflects the unslaved mode, and that the pan and tilt controls function as anticipated.

Task Completion Times:

7-10 sec - Infrequent

Initiating Conditions:

1. The system is in slave mode
2. The current setting(s) are not appropriate for the mission
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Relative orientation of aircraft and camera

   - Graphical
2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual message/alert

   - Visual state change
2.
3.

Task: Note Vehicle Slave Status Indicator

Task Description: The operator periodically glances at the Slave Status Indicator to confirm the current camera positioning mode. A decision is made as to whether there is a need to initiate a change to the system.

Task Completion Times:

2-5 sec - Very infrequent

Initiating Conditions:

1. The AIMS system is in use
2.
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. None

   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Pan/Tilt Sensitivity

Task Description: The operator adjusts pan and/or tilt sensitivity by activating the Pan/Tilt Sensitivity functions on the maintenance control panel. The default enables the operator to adjust both pan and tilt simultaneously, but the option also exists to adjust them independently.

Task Completion Times:

7-10 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2. The operator will be using the Pan and Tilt control functions
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Current sensitivity settings

   - Graphical

   - Textual (alphanumeric)
2.
3.
4.

Action Required:

1. Adjust parameter selection

   - Fixed/programmable function key

   - Rotary control (continuous or discrete)
2.
3.
4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Pan Angle

Task Description: The operator activates the Camera Panning function on the control panel to adjust the azimuth angle of the camera. This task is required either to concentrate on a particular geographical position or to conduct a systematic search of an area. During the performance of this task, the operator continuously monitors the camera imagery to ensure the desired coverage is obtained. The operator also monitors the bearing of the camera relative to either True North or aircraft heading. This task is normally performed while also adjusting the tilt angle.

Task Completion Times:

Highly variable, including continuous for periods of time - Very frequent

Initiating Conditions:

1. The positioning of the camera requires adjustment
2. The system is in manual control mode
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Desired pan angle

   - Graphical
2. Relative orientation of aircraft and camera

   - Graphical
3.
4.

Action Required:

1. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2. Tactile feedback

   - Tactile
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust Tilt Angle

Task Description: The operator activates the Camera Tilt function on the control panel to adjust the elevation angle of the camera. This task is required either to concentrate on a particular geographical position or to conduct a systematic search of an area. During the performance of this task, the operator continuously monitors the camera imagery to ensure the desired coverage is obtained. The operator also monitors camera elevation relative to the horizon. This task is normally performed while also adjusting the camera panning angle.

Task Completion Times:

Highly variable, including continuous for periods of time - Very frequent

Initiating Conditions:

1. The positioning of the camera requires adjustment
2. The system is in manual control mode
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Desired tilt angle

   - Graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.
4.

Action Required:

1. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Tactile feedback

   - Tactile

3.

Task: Slew Turret to Centre Contact on Display

Task Description: The operator initiates the slewing of the camera to a specific contact or geographical position on the display. This is accomplished by designating the contact or position and activating the Slew-to-Contact function on the control panel. The operator monitors the imagery and the camera position to verify that the camera is slewed to the desired position.

Task Completion Times:

10-30 sec - Frequent

Initiating Conditions:

1. The system is in manual control mode
2. There is a need to position the camera to view a particular contact
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Location of contact or geographical position for slewing the camera
   - Graphical
   - Textual (alphanumeric)
2. Relative orientation of aircraft and camera
   - Graphical
3.
4.

Action Required:

1. Designate a position on the display
   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)
2. Make switch or function selection
   - Fixed/programmable function key
   - Discrete position control (e.g. toggle/rocker switch)
3. Perform visual inspection or monitoring function
   - Visual activity
4.

Feedback Required:

1. Appropriate information appears on the display
   - Visual state change
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Initiate Automatic Scanning Mode

Task Description: The operator initiates automatic camera scanning by selecting the Auto-Scan function on the control panel and selecting a pre-defined scan pattern. Selection of this function also provides the operator with a recommended aircraft groundspeed to ensure 100% coverage. The operator monitors the moving map display to ensure the search is providing the desired coverage.

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. The system is in manual control mode or mosaic mode

2. Use of automatic scanning would be appropriate for the mission

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Desired parameters for automatic scanning

- Combination textual/graphical

2. Relative orientation of aircraft and camera

- Graphical

3.

4.

Action Required:

1. Adjust parameter selection

- Fixed/programmable function key

- Rotary control (continuous or discrete)

2. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

- Visual activity

4.

Feedback Required:

1. Appropriate imagery appears on the display

- Visual state change

2. Appropriate information presented to the operator

- Visual state change

3. Visual indication of equipment status

- Indicator light (on/off); Visual message/alert

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Terminate Automatic Scanning Mode

Task Description: The operator terminates automatic camera scanning by de-selecting the Auto-Scan function on the control panel. The operator verifies that the system status indicator is updated to reflect the manual steering mode, and the camera angle no longer changes automatically. The operator also verifies that the Pan and Tilt functions are available and functional.

Task Completion Times:

5-7 sec - Infrequent

Initiating Conditions:

1. The system is in automatic scanning mode

2. Use of automatic scanning is no longer appropriate for the mission

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

- Not applicable

2. Relative orientation of aircraft and camera

- Graphical

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Perform visual inspection or monitoring function

- Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Enter Mosaic Sweep Parameters

Task Description: The operator will enter the necessary input parameters to allow mosaic generation at the desired resolution. The system will provide assistance to ensure that the input parameters allow for mosaic generation (e.g. provides the operator with a recommended aircraft groundspeed to ensure 100% coverage).

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. The system is in manual control mode or automatic scanning mode

2. Use of mosaic mode would be appropriate for the mission

3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Desired parameters for mosaic mode

- Combination textual/graphical

2. Desired aircraft parameters

- Combination textual/graphical

3. Mission requirements and objectives

- Combination textual/graphical

- Memory

4.

Action Required:

1. Adjust parameter selection

- Fixed/programmable function key

- Alphanumeric entry

2. Make switch or function selection

- Fixed/programmable function key

3. Perform visual inspection or monitoring function

- Visual activity

4. Evaluate information and make decision or assessment

- Mental activity

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2.

3.

Task: Initiate Mosaic Mode

Task Description: The operator initiates mosaic mode by selecting the Mosaic Mode function on the control panel. The operator monitors the moving map display to ensure the search is providing the desired coverage.

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. The system is in manual control mode or automatic scanning mode
2. Use of mosaic mode would be appropriate for the mission
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Desired parameters for mosaic mode

   - Combination textual/graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.

4.

Action Required:

1. Adjust parameter selection

   - Fixed/programmable function key

   - Rotary control (continuous or discrete)

2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Appropriate imagery appears on the display

   - Visual state change

2. Appropriate information presented to the operator

   - Visual state change

3. Visual indication of equipment status

   - Indicator light (on/off); Visual message/alert

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Terminate Mosaic Mode

Task Description: The operator terminates mosaic mode by de-selecting the Mosaic Mode function on the control panel. The operator verifies that the system status indicator is updated to reflect the manual steering mode, and the camera angle no longer changes automatically. The operator also verifies that the Pan and Tilt functions are available and functional.

Task Completion Times:

5-7 sec - Infrequent

Initiating Conditions:

1. The system is in mosaic mode
2. Use of mosaic mode is no longer appropriate for the mission
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

   - Not applicable

2. Relative orientation of aircraft and camera

   - Graphical

3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

2. Appropriate information appears on the display

   - Visual state change

3.

Task: Resume Mosaic Mode

Task Description: The operator resumes the mosaic mode. The system will continue to ensure there is no loss of coverage.

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. The system is in manual control mode or automatic scanning mode
2. Use of mosaic mode would be appropriate for the mission
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Desired parameters for mosaic mode

   - Combination textual/graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.

4.

Action Required:

1. Adjust parameter selection

   - Fixed/programmable function key

   - Rotary control (continuous or discrete)

2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Appropriate imagery appears on the display

   - Visual state change

2. Appropriate information presented to the operator

   - Visual state change

3. Visual indication of equipment status

   - Indicator light (on/off); Visual message/alert

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Detect Platform Drift

Task Description: The operator detects that the platform is drifting in one or more dimensions. An assessment is made as to whether the drift will impact the mission. The operator also makes a decision as to whether to eliminate the drift from the system.

Task Completion Times:

5-10 sec - Very infrequent

Initiating Conditions:

1. The AIMS system is in operational use
2. The gyro has drifted
3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Angle between correct and current platform alignment

   - Graphical

   - Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Perform visual inspection or monitoring function

   - Visual activity

3.

4.

Feedback Required:

1. None

   - Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Null Platform Drift

Task Description: Having detected that the platform is drifting from its commanded position, the operator attempts to eliminate the drift by activating the Null Drift function on the control panel. The operator monitors the platform re-alignment process, and verifies that the drift is eliminated from the system. The operator may also perform this task during system initialization prior to flight.

Task Completion Times:

10-45 sec - Very infrequent

Initiating Conditions:

1. The AIMS system is in operational use
2. The gyro has drifted
3.

Decision Required:

Decisional Rating Four: This task has a significant decisional component that overshadows the other cognitive content.

Information Required:

1. Angle between correct and current platform alignment

   - Graphical

   - Textual (alphanumeric)

2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Monitor Status of AIMS Display

Task Description: The operator visually monitors the status of the AIMS display to ensure maximum effectiveness in accomplishing mission objectives. This task, which is conducted periodically throughout the mission, consists of evaluating the quality of display characteristics such as brightness, contrast, focus and colour. The operator makes a decision as to whether action is required to improve any of the display attributes.

Task Completion Times:

Continuous throughout the mission - Very frequent

Initiating Conditions:

1. The AIMS system is in operational use

2.

3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Equipment serviceability and status indications

- Indicator light (on/off)

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Monitor Status of Laser Illuminator

Task Description: The operator monitors the status of the Laser Illuminator for situational awareness and to ensure proper operation. This task involves verifying that the laser is armed or de-armed as appropriate, active or passive as appropriate, and that there are no system malfunctions indicated such as an over-temperature situation. In addition, the operator will monitor the "eye safety range" to ensure that the illuminator is not presenting a hazard to individuals on the ground. This task is performed periodically by the operator during all missions in which the AIMS system is in use.

Task Completion Times:

Continuous throughout the mission - Very frequent

Initiating Conditions:

1. The AIMS system is in operational use
2.
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Equipment serviceability and status indications

   - Indicator light (on/off)

   - Textual (alphanumeric)
2.
3.
4.

Action Required:

1. Listen and interpret information

   - Mental processing activity
2. Perform visual inspection or monitoring function

   - Visual activity
3.
4.

Feedback Required:

1. None

   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Monitor Status of Video Recorder

Task Description: The operator periodically checks the status of the video recorder to ensure it is functioning properly and there is adequate tape remaining. If the tape is running low, the operator makes a mental note that the tape will need to be changed at some time in the near future. A warning may be presented to the operator when the time remaining on the tape is extremely low.

Task Completion Times:

Continuous throughout the mission - Very frequent

Initiating Conditions:

1. The AIMS system is in operational use

2. There is a need to record video imagery

3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Equipment serviceability and status indications

- Indicator light (on/off)

- Textual (alphanumeric)

2. Indication of the recording time available on the tape

- Graphical

3.

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2.

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Replace Tape in the Video Recorder

Task Description: The operator retrieves a new video tape and ensures it is annotated with the start time as required for the current mission. The tape in the recorder is removed and replaced with the new one. The removed tape is annotated with the stop time and other mission information as required. It is then stowed in a secure facility for the transit and landing phase of the mission.

Task Completion Times:

60-120 sec - Infrequent

Initiating Conditions:

1. The current video tape is at (or near) its end

2. There is a need to continue to record video imagery

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. Indication of the recording time available on the tape

- Graphical

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Record information manually

- Writing tools

- Keyboard

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust CRT Display Characteristics

Task Description: The operator adjusts one or more of the CRT display controls to enhance the usability of the information presented on it. During the performance of this task, which usually involves adjustments to the brightness and contrast controls, the operator monitors the display to achieve the best possible performance.

Task Completion Times:

7-10 sec - Very infrequent

Initiating Conditions:

1. The CRT requires adjustment for improved performance

2.

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust System Maintenance Controls

Task Description: The operator makes minor adjustments to one or more maintenance control functions to optimize the performance of the AIMS system for increased mission effectiveness. This task, which is normally performed by maintenance personnel prior to flight, is rarely required to be performed by the operator during a mission. The task involves making minor adjustments to one or more maintenance control functions such as pre-set gain, brightness and contrast settings, auto-level settings (thresholds), default options, etc. The operator visually monitors the quality of imagery and alphanumeric data presented on the display during the performance of this task.

Task Completion Times:

10-240 sec - Very infrequent

Initiating Conditions:

1. System performance has deteriorated
2. The current setting(s) are not appropriate for the mission
3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Checklist/equipment operating procedures

   - Textual (alphanumeric)

2. Standard Operating Procedures

   - Textual (alphanumeric)

3.
4.

Action Required:

1. Adjust parameter selection

   - Fixed/programmable function key

   - Rotary control (continuous or discrete)

2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

3. Read and interpret information

   - Mental processing activity

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Tactile feedback

   - Tactile

3. Visual indication of equipment status

   - Indicator light (on/off); Visual message/alert

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Discuss Weather Predicted for Area

Task Description: The operator solicits information from other crew members on the weather conditions that are anticipated for the On Task area. The operator is likely to make brief written notes for future reference in planning the utilization of the AIMS sensor system. This task, which is required to augment information available in the mission briefing package, is particularly critical if the AIMS operator did not have the opportunity to attend the pre-flight weather briefing.

Task Completion Times:

30-120 sec - Infrequent

Initiating Conditions:

1. The operator is conducting mission planning

2. There is a need to obtain information on weather in the area

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Environmental conditions in area (forecast or actual)

- Combination textual/graphical

- Memory

2.

3.

4.

Action Required:

1. Listen and interpret information

- Mental processing activity

2. Record information manually

- Writing tools

- Keyboard

3. Speak

- Mental processing activity

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Review Known Features of Search Object

Task Description: The operator solicits information to determine the characteristics of the search object that are likely to be significant to the search. The operator also refers to sensor performance data to assist in identifying characteristics that are particularly critical to the search. The operator may make brief written notes for future reference during both the planning and conduct of the search.

Task Completion Times:

60-180 sec - Infrequent

Initiating Conditions:

1. The operator is conducting mission planning
2.
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Information on the object of the search
   - Graphical
   - Textual (alphanumeric)
2. Sensor performance data
   - Textual (alphanumeric)
3.
4.

Action Required:

1. Read and interpret information
   - Mental processing activity
2. Record information manually
   - Writing tools
   - Keyboard
3.
4.

Feedback Required:

1. None
   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Review Terrain in Search Area

Task Description: The operator reviews a geographical map of the search area to determine the type of terrain that can be expected.

Task Completion Times:

60-180 sec - Infrequent

Initiating Conditions:

1. The operator is conducting mission planning

2.

3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Geographical map of area

- Combination textual/graphical

2. Information on the terrain in the area of interest

- Graphical

3.

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2. Read and interpret information

- Mental processing activity

3. Record information manually

- Writing tools

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Evaluate Expected Sensor Performance in Area

Task Description: The operator evaluates the expected performance of the AIMS sensor system in relation to mission objectives. The operator considers all relevant factors including: nature of the mission, characteristics of the search object, type of terrain in the area, local weather conditions, the flight profile (i.e. altitude and speed), and equipment serviceability. A decision is made on the detection range and reliability that can be expected for the sensor.

Task Completion Times:

Initiating Conditions:

1. The operator is conducting mission planning

2.

3.

Decision Required:

Information Required:

1. Environmental conditions in area and terrain

- Graphical
- Textual (alphanumeric)

2. Mission requirements and objectives

- Combination textual/graphical

3. Anticipated flight profile (altitude and speed)

- Memory
- Textual (alphanumeric)

4. Equipment serviceability and status indications

- Indicator light (on/off)

Action Required:

1.

2.

3.

4.

Feedback Required:

1.

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Report Expected Sensor Performance

Task Description: The operator briefs other crew members on the performance that can be expected from the AIMS sensor system. This report includes anticipated detection range for the object of the search, plus any other information that is relevant (e.g. equipment serviceability aspects, performance degradation due to weather, etc.). This report may be based on either observed or predicted performance.

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. Expected sensor performance has been determined

2.

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. Expected sensor performance

- Memory

2.

3.

4.

Action Required:

1. Read and interpret information

- Mental processing activity

2. Speak

- Mental processing activity

3.

4.

Feedback Required:

1. Verbal acknowledgement

- Verbal

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Develop Initial Search Plan

Task Description: Having determined the expected performance of the AIMS and other sensor systems, the operator develops the initial search plan. This plan emphasizes the utilization of the sensor system (or systems) that offer the best chance of accomplishing the mission. The plan defines all aspects of the search including the start point, direction of search, track spacing, flight profile (altitude and speed) and sensors to be utilized. Selection of the primary sensor(s) may involve support by the system whereby the operator enters in the mission parameters and the system reports the 'optimum' sensor and configuration for the search.

Task Completion Times:

180-300 sec - Infrequent

Initiating Conditions:

1. Expected sensor performance has been determined

2. The operator is conducting mission planning

3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Expected sensor performance

- Memory

2. Mission time constraints

- Textual (alphanumeric)

3. Sensor performance data

- Textual (alphanumeric)

- Memory

4. Standard Operating Procedures

- Textual (alphanumeric)

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

3. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

4. Read and interpret information

- Mental processing activity

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Determine Subsequent Search Plan

Task Description: The operator considers the relative merits of alternative search methods, and determines an alternative search plan to be implemented in the event the initial plan does not achieve desired results. The plan defines all aspects of the search including the start point, direction of search, track spacing, flight profile (altitude and speed) and sensors to be utilized.

Task Completion Times:

60-120 sec - Infrequent

Initiating Conditions:

1. Expected sensor performance has been determined
2. The operator is conducting mission planning
3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Expected sensor performance
   - Memory
2. Mission time constraints
   - Textual (alphanumeric)
3. Sensor performance data
   - Textual (alphanumeric)
   - Memory
4. Standard Operating Procedures
   - Textual (alphanumeric)

Action Required:

1. Evaluate information and make decision or assessment
   - Mental processing activity
2. Read and interpret information
   - Mental processing activity
3. Record information manually
   - Writing tools
4.

Feedback Required:

1. None
   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Report AIMS System Serviceability

Task Description: The operator briefs other crew members on the serviceability of the AIMS system. This briefing includes an assessment of the impact of any unserviceabilities on the likelihood of being able to accomplish mission objectives.

Task Completion Times:

10-60 sec - Infrequent

Initiating Conditions:

1. AIMS serviceability has been determined

2.

3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Equipment serviceability and status indications

- Indicator light (on/off)

- Textual (alphanumeric)

2.

3.

4.

Action Required:

1. Read and interpret information

- Mental processing activity

2. Speak

- Mental processing activity

3.

4.

Feedback Required:

1. Verbal acknowledgement

- Verbal

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Update System Parameters for Search

Task Description: In consideration of the search plan to be implemented, the operator accesses the System Status Information, evaluates the appropriateness of each setting, and adjusts any that are not appropriate for the search phase. The decision to change parameter settings is based primarily on the environmental conditions in the area, and a re-assessment of the likelihood that the search object will be cooperative. The operator verifies visually that all changes are updated in the system.

Task Completion Times:

30-120 sec - Frequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission

2.

3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Environmental conditions in the area

- Memory

2. Checklist/equipment operating procedures

- Textual (alphanumeric)

3. Standard Operating Procedures

- Textual (alphanumeric)

4. Correct parameter settings

- Memory

Action Required:

1. Adjust parameter selection

- Fixed/programmable function key

- Rotary control (continuous or discrete)

2. Evaluate information and make decision or assessment

- Mental processing activity

3. Make switch or function selection

- Fixed/programmable function key

4. Perform visual inspection or monitoring function

- Visual activity

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Conduct Pre-Search Briefing

Task Description: A pre-search briefing involving all crew members is conducted on the aircraft intercom system. The Aircraft Captain initiates the briefing, and ensures the objectives of the mission are fully understood by everyone. Other operators brief individual aspects of the mission as required. Equipment unserviceabilities will also be reviewed at this time. The AIMS operator refers to a map of the area as required for situational awareness during the conduct of the briefing. The operator may also make written notes for reference throughout the mission.

Task Completion Times:

45-120 sec - Infrequent

Initiating Conditions:

1. All operators are in position
2. The aircraft is approaching the start position for the search
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Mission requirements and objectives
   - Combination textual/graphical
   - Memory
2. Equipment serviceability and status indications
   - Indicator light (on/off)
3.
4.

Action Required:

1. Listen and interpret information
   - Mental processing activity
2. Record information manually
   - Writing tools
   - Keyboard
3. Speak
   - Mental processing activity
4.

Feedback Required:

1. None
   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Configure Moving Map Display

Task Description: Prior to the conducting the search, the operator will configure the moving map to best meet the operational requirements. This includes selecting and configuring overlays to be displayed (e.g. known crash sites, sensor coverage) and choosing map orientation, scale, zoom, data format etc. The operator may re-configure these settings during the mission to better suit the search conditions.

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission
2. The operator is conducting mission planning
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Definition of the area of interest

   - Graphical

2. Information on the tactics for the mission

   - Memory

3. Relative orientation of aircraft and cameras

   - Graphical

4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function keys

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Receive Report of Actual Weather Conditions from Flight Deck Crew

Task Description: The operator receives a verbal report from the flight deck crew on the actual weather conditions in the vicinity of the aircraft. This report includes information such as ceiling, visibility, type and extent of cloud cover, precipitation (if any), winds at altitude, and prevailing light conditions (particularly during dawn and dusk times).

Task Completion Times:

15-60 sec - Frequent

Initiating Conditions:

1. The information is volunteered

2. The information has been requested; or

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Listen and interpret information

- Mental processing activity

2. Record information manually

- Writing tools

- Keyboard

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Observe Local Weather Conditions on AIMS Display

Task Description: The operator visually inspects the video imagery to assist in determining actual weather conditions in the area. The operator also makes an assessment of the impact the weather is having on the quality of the imagery and overall sensor performance. The operator makes a decision as to whether any revisions are required in the tactics planned for the mission. The operator may also perform this task in situations when the AIMS is not being used as a primary search sensor (e.g. to augment a visual search).

Task Completion Times:

30-90 sec - Infrequent

Initiating Conditions:

1. The operator is conducting mission planning
2. There is a need to obtain information on weather in the area
3.

Decision Required:

Decisional Rating Five: This task has a significant decisional component that forms a large part of the cognitive content.

Information Required:

1. Definition of the area of interest

   - Graphical

2. Information on the tactics for the mission

   - Memory

3. Relative orientation of aircraft and camera

   - Graphical

4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. None

   - Not applicable

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Compare Actual and Forecast Weather Conditions

Task Description: Having determined actual weather conditions in the area, the operator compares the actual conditions with the original forecast for the area. A decision is made as to whether the actual conditions are sufficiently different to require a re-evaluation of sensor performance. The operator is likely to refer to the weather briefing package and consider discussions with other crew members during the performance of this task.

Task Completion Times:

30-60 sec - Infrequent

Initiating Conditions:

1. The operator is conducting mission planning

2.

3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Actual weather conditions

- Memory

- Textual (alphanumeric)

2. Forecast weather conditions

- Combination textual/graphical

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Read and interpret information

- Mental processing activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Determine Actual Sensor Performance in Area

Task Description: The operator re-evaluates sensor performance based on conditions actually observed in the area. This involves evaluating the likely impact of the environmental and terrain conditions that differ from the predictions, and making an assessment as to whether sensor performance is likely to be better or worse than predicted. The operator also checks the performance by observing the quality of the video imagery and determining actual detection ranges for objects similar to the subject of the search. The operator makes a decision as to whether mission tactics must be adjusted because of actual sensor performance.

Task Completion Times:

60-120 sec - Infrequent

Initiating Conditions:

1. The operator is conducting mission planning

2.

3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Information on the terrain in the area of interest

- Graphical

- Textual (alphanumeric)

2. Relative orientation of aircraft and camera

- Graphical

3. Environmental conditions in area (forecast or actual)

- Combination textual/graphical

- Memory

4. Expected sensor performance

- Memory

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Perform visual inspection or monitoring function

- Visual activity

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Monitor AIMS Display for Search Object

Task Description: The operator visually scans the video imagery in an attempt to identify the object of the search. The operator may refer occasionally to Standard Operating Procedures to assist in establishing a systematic search pattern to achieve maximum area coverage. This task may be conducted in conjunction with the Auto-Scan function or in a manual scan mode (by utilizing the Pan and Tilt functions).

Task Completion Times:

Continuous throughout the mission - Very frequent

Initiating Conditions:

1. The mission has commenced as tasked
2. The AIMS system is in operational use
3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Definition of the area of interest

   - Graphical

2. Information on the object of the search

   - Graphical

3. Relative orientation of aircraft and camera

   - Graphical

4. Standard Operating Procedures

   - Textual (alphanumeric)

Action Required:

1. Perform visual inspection or monitoring function

   - Visual activity

2. Read and interpret information

   - Mental processing activity

3.
4.

Feedback Required:

1. None

   - Not applicable

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Initiate/Deactivate Auto-cueing Function

Task Description: The operator activates/deactivates the image processing algorithms to support the Auto-Cueing function.

Task Completion Times:

2-3 sec - Infrequent

Initiating Conditions:

1. The mission has commenced as tasked

2. The AIMS system is in operational use

3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content

Information Required:

1. Mission requirements and objectives

- Combination textual/graphical

- Memory

2. Definition of the area of interest

- Graphical

3. Information on the object of the search

- Graphical

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable key

- Discrete position control

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light

- Visual message/alert

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Maintain a Record of Sensor Coverage of Area

Task Description: The operator maintains a record of the areas that have received sensor coverage as the search progresses. This is accomplished with map shading which is updated continuously (or at regular intervals) either manually or automatically. The operator refers to this information periodically to ensure the entire area is covered in the course of the mission. This information is also required during post-mission analysis to assist in planning subsequent missions.

Task Completion Times:

Continuous throughout the mission - Very frequent

Initiating Conditions:

1. The mission has commenced as tasked

2. The AIMS system is in operational use

3.

Decision Required:

Decisional Rating Three: This task is a decisional task consisting mostly of cognitive activity; only a single aspect is being considered.

Information Required:

1. Information on area that has been searched

- Graphical

2. Mission requirements and objectives

- Combination textual/graphical

3.

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2. Record information manually

- Writing tools

- Keyboard

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Receive Report of Radar or Visual Contact

Task Description: The operator receives a report of a contact that has been detected either visual or on radar. The report includes estimates of the type and position of the contact. The position information is reported as a range and bearing. The bearing may be reported using the standard clock system or in degrees relative to either True North or aircraft heading. The operator refers to the display for situational awareness during the performance of this task, and records the information manually for future reference.

Task Completion Times:

10-20 sec - Frequent

Initiating Conditions:

1. None
2.
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Relative orientation of aircraft and camera

   - Graphical
2.
3.
4.

Action Required:

1. Listen and interpret information

   - Mental processing activity
2. Perform visual inspection or monitoring function

   - Visual activity
3. Record information manually

   - Writing tools
4.

Feedback Required:

1. None

   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Slew Turret to Radar or Visual Contact

Task Description: The operator slews the turret to the geographic position of a contact detected either visually or on radar. This is accomplished either by entering the range and bearing to the contact and initiating the Auto-Slew function, or by manually adjusting the Pan and Tilt control functions in response to the directions provided. The operator verifies that the camera angle and video imagery are updated as expected.

Task Completion Times:

20-60 sec - Frequent

Initiating Conditions:

1. A radar or visual contact of interest has been reported

2.

3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Positional information for radar or visual contact

- Graphical

- Textual (alphanumeric)

2. Relative orientation of aircraft and camera

- Graphical

3.

4.

Action Required:

1. Enter data

- Keyboard

2. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

3. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

4. Perform visual inspection or monitoring function

- Visual activity

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Set AIMS Auto-Scan Parameters

Task Description: The operator selects the desired auto-scan pattern from a preset list. This activity is normally conducted prior to the commencement of the search, but may also be conducted at other times as required to improve the probability of detection. The operator may refer to Standard Operating Procedures during the performance of this task.

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. The current setting(s) are not appropriate for the mission

2. Use of automatic scanning would be appropriate for the mission

3.

Decision Required:

Decisional Rating Three: This task is a decisional task consisting mostly of cognitive activity; only a single aspect is being considered

Information Required:

1. Checklist/equipment operating procedures

- Textual (alphanumeric)

2. Standard Operating Procedures

- Textual (alphanumeric)

3. Correct parameter settings

- Memory

4. Mission requirements and objectives

- Combination textual/graphical; Memory

Action Required:

1. Adjust parameter selection

- Fixed/programmable function key
- Rotary control (continuous or discrete)

2. Evaluate information and make decision or assessment

- Mental processing activity

3. Perform visual inspection or monitoring function

- Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)
- Visual message/alert

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Re-Initiate Search at Previously-Designated Position

Task Description: Having completed a contact investigation, the operator re-initiates the search for the object of the search at a previously designated position. This task is performed in conjunction with the pilot re-establishing the aircraft on the proper flight profile. The operator monitors the accuracy of the aircraft position, providing verbal guidance to the pilot as necessary. The operator verifies that the AIMS system is correctly configured for the search, and re-initiates scanning at the appropriate time (in either automatic or manual scanning mode).

Task Completion Times:

30-120 sec - Frequent

Initiating Conditions:

1. The operator has a designated position to re-initiate the search

2. A decision has been made to re-initiate a previously-interrupted search

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Aircraft altitude and position when search was interrupted

- Combination textual/graphical

2. Desired search parameter settings

- Combination textual/graphical

3. Previously-designated position on the display

- Graphical

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Perform visual inspection or monitoring function

- Visual activity

3. Speak

- Mental processing activity

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Designate Targets

Task Description: The operator while viewing imagery (mosaic or real-time) marks a potential targets. The operator visually verifies that the moving map display is updated with an overlay. The operator may also enter a short text comment to accompany the designated target.

Task Completion Times:

2-3 sec - Frequent

Initiating Conditions:

1. The mission has commenced as tasked

2. There is a need to record a geographical position

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content.

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Capture Single Frame Imagery

Task Description: The operator captures still frame images from the primary by activating the Capture function on the control panel.

Task Completion Times:

5-7 sec - Frequent

Initiating Conditions:

1. The mission has commenced as tasked

2. There is a need to capture single frame imagery (snapshots)

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Begin Recording AIMS Images

Task Description: The operator initiates video recording by activating the Record function on the control panel. The recording will capture both the AIMS imagery as well as the associated meta data. The operator verifies that the video recorder status is updated and the tape counter begins counting as expected. Initiation of the video recording may also occur upon commencing the search.

Task Completion Times:

5-7 sec - Infrequent

Initiating Conditions:

1. The mission has commenced as tasked
2. There is a need to record video imagery
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

   - Not applicable

2.
3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Report Status of Video Recording

Task Description: The operator advises the other crew members that video recording has been either initiated or terminated. If applicable, the reason for the change will also be briefed.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. The status of the video recorder has changed
2.
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Speak

   - Mental processing activity
2.
3.
4.

Feedback Required:

1. Verbal acknowledgement

   - Verbal
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Detect Contact on AIMS Display

Task Description: While monitoring the AIMS display, the operator visually detects a contact with characteristics associated with the object of the search. The operator notes the relative position of the contact plus aircraft position, heading, altitude and speed at the time of the detection to assist in relocating the contact if necessary. The operator conducts a preliminary analysis of the contact and makes an assessment as to whether the contact warrants further attention (i.e. do not investigate further, investigate immediately, or investigate at some later time).

Task Completion Times:

10-30 sec - Very frequent

Initiating Conditions:

1. The mission has commenced as tasked
2.
3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Own aircraft position, altitude, heading and speed

   - Combination textual/graphical
2. Information on the object of the search

   - Graphical
3. Relative orientation of aircraft and camera

   - Graphical
4.

Action Required:

1. Perform visual inspection or monitoring function

   - Visual activity
2. Evaluate information and make decision or assessment

   - Mental processing activity
3.
4.

Feedback Required:

1. None

   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Report AIMS Detection

Task Description: The operator alerts the other crew members to the fact that a contact has been detected that may be the object of the search. This report includes an estimate of the approximate position of the contact (i.e. bearing and range, possibly with reference to the clock system), plus an indication of the likelihood that it is the object of the search. The operator continues to focus attention on the object to ensure it is not lost.

Task Completion Times:

5-10 sec - Very frequent

Initiating Conditions:

1. The operator has visually detected a contact of interest on the display
2. The mission has commenced as tasked
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Assessment of the likelihood the contact is the object of the search
   - Memory
2. Position of the contact
   - Combination textual/graphical
3. Relative orientation of aircraft and camera
   - Graphical
4.

Action Required:

1. Speak
   - Mental processing activity
2.
3.
4.

Feedback Required:

1. Verbal acknowledgement
   - Verbal
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Initiate a Contact File

Task Description: The operator initiates a contact file on the detected contact. This is accomplished by designating the contact on the video imagery. The contact is assigned a waypoint number, and the relative position information is transferred to the navigation system where a geographic position is calculated. The waypoint also appears on the moving map display annotated with the waypoint number. A screen capture image is stored for future reference. The operator may make handwritten notes about the contact on a notepad.

Task Completion Times:

15-60 sec - Infrequent

Initiating Conditions:

1. A new contact of interest has been detected
2. The mission has commenced as tasked
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Contact classification

   - Memory

2. Location of contact of interest

   - Combination textual/graphical

3.
4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Designate a position on the display

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Enter data

   - Keyboard

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2.
3.

Task: Terminate Recording AIMS Images

Task Description: The operator terminates video recording by de-selecting the Record function on the control panel. The operator verifies that the video recorder status is updated and the tape counter stops counting as expected.

Task Completion Times:

5-10 sec - Infrequent

Initiating Conditions:

1. The video recorder is in the record mode

2. There is no longer a need to record video imagery

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Perform visual inspection or monitoring function

- Visual activity

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Track AIMS Contact Manually

Task Description: Having detected a contact of interest, the operator tracks the contact manually with the AIMS system. This is accomplished by making continuous adjustments to the Pan and Tilt angles to maintain the approximate centre of the video FOV on the contact.

Task Completion Times:

Continuous when requirement exists - Frequent

Initiating Conditions:

1. A contact of interest has been detected
2. The manual tracking mode is appropriate for the mission
3. There is a need to continue to monitor the contact

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Location of contact of interest

   - Graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.

4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Tactile feedback

   - Tactile

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Initiate Geo-Tracking (AUTO POINT) mode

Task Description: The operator initiates automatic tracking of the AIMS system by designating a particular geographic location (by entering a lat/long or clicking a point on the moving map) and activating the Auto-Track function on the control panel. The operator verifies that the system status information reflects the AUTO-POINT Mode, and that the centre of the video FOV remains centered on the designated geographic position.

Task Completion Times:

5-7 sec - Frequent

Initiating Conditions:

1. A contact of interest has been detected
2.
3.

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Location of geographic point of interest

   - Combination textual/graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.
4.

Action Required:

1. Designate a position on the display

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Initiate AIMS Automatic Tracking

Task Description: The operator initiates automatic tracking of the AIMS system by designating a particular contact and activating the Auto-Track function on the control panel. The operator verifies that the system status information reflects the Auto-Track Mode, and that the centre of the video FOV remains centered on the designated contact of interest.

Task Completion Times:

5-7 sec - Frequent

Initiating Conditions:

1. A contact of interest has been detected
2. The automatic tracking mode is appropriate for the mission
3. There is a need to continue to monitor the contact

Decision Required:

Decisional Rating Six: This task has a decisional component that forms a moderate amount of the cognitive content.

Information Required:

1. Location of contact of interest

   - Combination textual/graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.

4.

Action Required:

1. Designate a position on the display

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

3. Perform visual inspection or monitoring function

   - Visual activity

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Adjust AIMS Automatic Tracking Manually

Task Description: Having observed that the Automatic Tracking function has not maintained the position in the centre of the FOV, the operator manually adjusts the camera alignment to re-centre the image. This is accomplished using the Pan and Tilt functions while visually monitoring the display to achieve accurate positioning.

Task Completion Times:

5-15 sec - Frequent

Initiating Conditions:

1. A contact is being tracked using the automatic tracking mode
2. The contact being tracked has drifted from the centre of the FOV
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Positioning of contact of interest within the FOV

   - Graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.
4.

Action Required:

1. Perform visual inspection or monitoring function

   - Visual activity

2. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3.
4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Tactile feedback

   - Tactile

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Report AIMS Automatic Tracking

Task Description: The operator advises the other crew members that the contact of interest is being automatically tracked by the AIMS system.

Task Completion Times:

3-10 sec - Frequent

Initiating Conditions:

1. Automatic tracking of a contact has been initiated

2.

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Speak

- Mental processing activity

2.

3.

4.

Feedback Required:

1. Verbal acknowledgement

- Verbal

2.

3.

Task: Monitor the Accuracy of the Automatic Tracking Function

Task Description: The operator periodically evaluates the accuracy of the automatic tracking function by observing the relative location of the contact or position of interest within the camera FOV. The operator makes a decision as to whether there is a need to make a manual adjustment to the tracking function.

Task Completion Times:

Continuous when function is engaged - Frequent

Initiating Conditions:

1. Automatic tracking of a contact has been initiated
2.
3.

Decision Required:

Decisional Rating Three: This task is a decisional task consisting mostly of cognitive activity; only a single aspect is being considered.

Information Required:

1. Positioning of contact of interest within the FOV

   - Graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.
4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. None

   - Not applicable

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Advise Pilot of the Status of the AIMS Tracking Function

Task Description: The operator verbally advises the pilot of the status of the AIMS function. The information exchanged typically includes whether the system is in automatic or manual tracking mode. The operator also advises the pilot of the accuracy of the tracking system.

Task Completion Times:

5-15 sec - Frequent

Initiating Conditions:

1. The operator is tracking a contact either automatically or manually
2. The system may, or may not, be configured to automatically send steering information to the aircraft flight control or navigation systems
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. Status of steering information to the flight control and navigation systems

   - Indicator light (on/off)

2. Tracker serviceability and status indications

   - Indicator light (on/off)

3.
4.

Action Required:

1. Perform visual inspection or monitoring function

   - Visual activity

2. Speak

   - Mental processing activity

3.
4.

Feedback Required:

1. Verbal acknowledgement

   - Verbal

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Monitor Contact on AIMS Display

Task Description: The operator visually monitors the contact on the AIMS display. The purpose of this task is to ensure that contact is not lost, and to possibly obtain additional information on the contact as it is viewed from a different perspective.

Task Completion Times:

Continuous when appropriate - Frequent

Initiating Conditions:

1. A contact of interest has been detected on the display

2. There is a need to continue to monitor a contact

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Location of contact of interest

- Combination textual/graphical

2. Relative orientation of aircraft and camera

- Graphical

3.

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2.

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Identify AIMS Contact

Task Description: The operator analyzes the imagery to determine whether the contact is the subject of the search. During the performance of this task, the operator uses the zoom function extensively, and adjusts other system parameters to increase the probability of identification. The operator may replay the video recording to be able to view the image in slow time. For difficult contacts, the operator considers ways to increase the likelihood of a positive identification.

Task Completion Times:

15-60 sec - Frequent

Initiating Conditions:

1. A contact of interest has been detected
2. There is a need to identify the contact
3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Location of contact of interest

   - Combination textual/graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.
4.

Action Required:

1. Adjust parameter selection

   - Fixed/programmable function key

   - Rotary control (continuous or discrete)

2. Evaluate information and make decision or assessment

   - Mental processing activity

3. Make switch or function selection

   - Fixed/programmable function key

4. Perform visual inspection or monitoring function

   - Visual activity

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Report Contact Identification

Task Description: The operator advises the other crew members of the identity of the contact of interest or, alternatively, indicates that an identification is not possible. If applicable, the report also includes an assessment of the degree of certainty of the identity of the contact. If the contact could not be identified, the report may also include recommendations on how a positive identification may be achieved.

Task Completion Times:

5-10 sec - Frequent

Initiating Conditions:

1. A contact of interest has been classified
2.
3.

Decision Required:

Decisional Rating Ten: This task includes a visual, auditory, or psychomotor component, with no decisional aspects to any cognitive content.

Information Required:

1. Identification of contact

   - Memory
2.
3.
4.

Action Required:

1. Speak

   - Mental processing activity
2.
3.
4.

Feedback Required:

1. Verbal acknowledgement

   - Verbal
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Determine Range and Bearing to Contact

Task Description: The operator determines the range and bearing from the aircraft to the target from the display of camera angle and range. The operator has the option of obtaining the bearing relative to either True North or aircraft heading.

Task Completion Times:

10-25 sec - Frequent

Initiating Conditions:

1. A contact of interest has been detected
2. There is a need to obtain range and bearing information on a contact
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Relative orientation of aircraft and camera

   - Graphical
2. Location of contact of interest

   - Combination textual/graphical
3.
4.

Action Required:

1. Designate a position on the display

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)
2. Evaluate information and make decision or assessment

   - Mental processing activity
3. Make switch or function selection

   - Fixed/programmable function key
4. Record information manually

   - Writing tools

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change
2.
3.

Task: Report Range and Bearing to Contact

Task Description: The operator advises the other crew members of the range and bearing from the aircraft to the contact of interest. The information must be passed in a format that is readily usable by the recipients. The bearing may be passed relative to either True North or aircraft heading.

Task Completion Times:

5-10 sec - Frequent

Initiating Conditions:

1. Other crew members have requested or require the information

2. Range and bearing to a contact has been determined

3.

Decision Required:

Decisional Rating Ten: This task includes a visual, auditory, or psychomotor component, with no decisional aspects to any cognitive content.

Information Required:

1. Range and bearing to the contact

- Combination textual/graphical

2.

3.

4.

Action Required:

1. Speak

- Mental processing activity

2.

3.

4.

Feedback Required:

1. Verbal acknowledgement

- Verbal

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Monitor Estimated Range to Contact

Task Description: The operator monitors the estimated range to the target for situational awareness and to ensure optimal functioning of the AIMS. Since the system does not possess a laser rangefinder, the range is determined through calculations.

Task Completion Times:

Continuous when appropriate - Frequent

Initiating Conditions:

1. A continuous readout of range and bearing to a contact has been selected

2. There is a need for continuous range and bearing information

3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Location of contact of interest

- Combination textual/graphical

2. Relative orientation of aircraft and camera

- Graphical

3.

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2. Perform mental computation

- Mental processing activity

3. Record information manually

- Writing tools

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Mark Index on Recording

Task Description: The operator inserts a reference mark on the video recording to mark a point of interest for airborne or post-mission analysis replay. This is accomplished by activating the Recorder Index function on the control panel. The operator makes a voice annotation on the tape to indicate the reason for the index. The operator makes a mental note of the number of the reference mark to facilitate locating the contact on the tape if required.

Task Completion Times:

5-10 sec - Frequent

Initiating Conditions:

1. A time of interest relative to the video imagery has been determined
2. There may be a need to replay the current position on the tape (either in-flight or post-mission)
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

   - Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

   - Fixed/programmable function key

   - Discrete position control (e.g. toggle/rocker switch)

2. Speak

   - Mental processing activity

3.

4.

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Playback Video Imagery

Task Description: Having determined a need to re-evaluate video imagery, the operator stops the recording and rewinds the tape to the desired position. This is accomplished by activating the Tape Rewind function on the control panel, and inserting the applicable Tape Index number. The Tape Replay function is then activated, the operator verifies that the tape has been rewound to the correct position, and then monitors the taped video as necessary. The operator verifies that the system status information reflects the tape replay status. The operator also has the option to adjust the contrast while in the replay mode.

Task Completion Times:

As long as necessary - Infrequent

Initiating Conditions:

1. A portion of the tape has been identified as being significant to the mission

2. There is a need to conduct additional analysis of recorded imagery

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Desired tape position (reference mark or time/footage counter)

- Textual (alphanumeric)

- Graphical

2. Relative orientation of aircraft and camera at time of recording

- Graphical

3. Situational awareness information related to the portion of tape being replayed

- Graphical

4.

Action Required:

1. Perform visual inspection or monitoring function

- Visual activity

2. Enter data

- Keyboard

3. Make switch or function selection

- Fixed/programmable function key

4. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

Feedback Required:

1. Appropriate information appears on the display

- Visual state change

2. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Review Still Frame Imagery

Task Description: Having determined a need to re-evaluate still frame imagery, the operator selects the desired image(s).

Task Completion Times:

As long as necessary - Frequent

Initiating Conditions:

1. A single frame image has been identified as being significant to the mission
2. There is a need to conduct additional analysis of captured imagery
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Desired image

   - Textual (alphanumeric)

   - Graphical

2. Relative orientation of aircraft and camera at time of recording

   - Graphical

3. Situational awareness information related to the portion of tape being replayed

   - Graphical

4.

Action Required:

1. Perform visual inspection or monitoring function

   - Visual activity

2. Enter data

   - Keyboard

3. Make switch or function selection

   - Fixed/programmable function key

4. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Decide if the Detected Contact is the Object of the Search

Task Description: The operator considers all information available on the detected contact and makes a decision as to whether it is likely to be the object of the search. The decision is based on a comparison of the information available on both the detected contact and the object of the search (i.e. contact position, last known position of the object of the search, results from the classification/identification of the contact, etc.).

Task Completion Times:

10-120 sec - Very frequent

Initiating Conditions:

1. A contact has been detected that may be the object of the search

2. An analysis of the contact has been completed

3.

Decision Required:

Decisional Rating One: This task is purely a decisional task consisting solely of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Information on the object of the search

- Graphical

- Textual (alphanumeric)

2. Information on contact of interest

- Combination textual/graphical

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2. Read and interpret information

- Mental processing activity

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

Task: Report if Contact is (or is not) the Search Object

Task Description: The operator briefs the other crew members on whether the detected object is likely to be the subject of the search. Depending on the accuracy of the classification/ identification process, the report is likely to address three options: the contact is likely the object of the search and rescue procedures should be initiated; the contact may be the object of the search and further attempts to classify/identify it should be initiated; or the contact is unlikely to be the object of the search and the search should be resumed. The report includes a brief summary of the reasons for the decision, plus an assessment of the reliability of the information.

Task Completion Times:

5-10 sec - Very frequent

Initiating Conditions:

1. A determination has been made on the likelihood of a contact being the search object
2. A contact has been detected that may be the object of the search
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Assessment of the reliability of the decision

   - Memory

2. Decision on whether contact is the object of the search

   - Memory

3. Justification for the decision

   - Memory

4.

Action Required:

1. Speak

   - Mental processing activity

2.
3.
4.

Feedback Required:

1. Verbal acknowledgement

   - Verbal

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Annotate Sensor Contact File

Task Description: The operator annotates a handwritten contact file with new information as it becomes available.

Task Completion Times:

15-60 sec - Infrequent

Initiating Conditions:

1. A contact file has been opened on the contact
2. Additional information on the contact has been determined
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Contact file number

   - Textual (alphanumeric)

2. Contact information to be updated

   - Textual (alphanumeric)

3. Location of contact of interest

   - Combination textual/graphical

4.

Action Required:

1. Designate a position on the display

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Enter data

   - Keyboard

3. Make switch or function selection

   - Fixed/programmable function key

4. Perform visual inspection or monitoring function

   - Visual activity

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Evaluate Area Coverage

Task Description: The operator visually inspects the moving map of the area and evaluates the extent of the area that has been adequately searched. This task is facilitated by the fact that the operator has maintained a continuous record of the areas that have been searched throughout the mission. The operator makes an estimate as to whether the search of the assigned area can be completed during the On Task period.

Task Completion Times:

15-60 sec - Frequent

Initiating Conditions:

1. The mission has commenced as tasked
2.
3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Geographical map of area

   - Graphical

2. Information on area that has been searched

   - Graphical

3. Mission requirements and objectives

   - Combination textual/graphical

   - Memory

4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Perform visual inspection or monitoring function

   - Visual activity

3.
4.

Feedback Required:

1. None

   - Not applicable

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Terminate Video Playback

Task Description: The operator terminates video playback by de-selecting the Playback function on the control panel. The tape is rewound to the end of the previously recorded portion of the tape in preparation for re-initiating tape recording. The operator verifies that the system status information is updated to reflect the fact that video replay has been terminated.

Task Completion Times:

5-7 sec - Infrequent

Initiating Conditions:

1. There is no further need to review previously-recorded video imagery

2. Video playback has been initiated

3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. None

- Not applicable

2.

3.

4.

Action Required:

1. Make switch or function selection

- Fixed/programmable function key

- Discrete position control (e.g. toggle/rocker switch)

2. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Perform visual inspection or monitoring function

- Visual activity

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2. Appropriate information appears on the display

- Visual state change

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Determine Nature of Local Terrain on AIMS Display

Task Description: The operator inspects the video display to determine the nature of the local terrain to conduct rescue operations. The operator uses the camera control functions (e.g. Pan, Tilt, Zoom, etc.) to assist in the performance of this task. The operator pays particular attention to the nature of the ground cover, the location and height of obstacles in the area, the slope of the terrain, and the proximity of open areas that could facilitate a hoist or helicopter landing. This task is conducted concurrently with similar assessments by other crewmembers.

Task Completion Times:

60-180 sec - Infrequent

Initiating Conditions:

1. A position of interest has been identified
2. There is a need to determine terrain features in a particular area
3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Definition of the area of interest

   - Graphical

2. Relative orientation of aircraft and camera

   - Graphical

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

   - Mental processing activity

2. Manipulate control, equipment or objects

   - Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

3. Perform visual inspection or monitoring function

   - Visual activity

4. Record information manually

   - Writing tools

Feedback Required:

1. Appropriate information appears on the display

   - Visual state change

2. Visual indication of equipment status

   - Indicator light (on/off)

   - Visual message/alert

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Assess Hazards in Area

Task Description: The operator mentally determines if the terrain features pose any hazards that are likely to impact subsequent SAR Tech operations. A decision is made as to whether there are any aspects of the terrain that warrant particular consideration.

Task Completion Times:

20-60 sec - Infrequent

Initiating Conditions:

1. A position of interest has been identified

2. There is a need to determine hazardous features in a particular area

3.

Decision Required:

Decisional Rating Two: This task is a decisional task consisting mostly of cognitive activity; multiple aspects are under consideration.

Information Required:

1. Definition of the area of interest

- Graphical

2.

3.

4.

Action Required:

1. Evaluate information and make decision or assessment

- Mental processing activity

2.

3.

4.

Feedback Required:

1. None

- Not applicable

2.

3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Maintain Situational Awareness Using Displays

Task Description: The operator monitors the display to maintain continuous situational awareness with respect to the mission in progress. The operator focuses on the following aspects of the mission: own aircraft position, altitude, speed and heading; relative positioning of the search area and detected contacts; terrain elevation and features; local weather conditions.

Task Completion Times:

Continuous throughout the mission - Very frequent

Initiating Conditions:

1. The mission has commenced as tasked
2. The AIMS system is in operational use
3.

Decision Required:

Decisional Rating Seven: This task includes a visual, auditory, or psychomotor component, with only modest decisional aspects to any cognitive content

Information Required:

1. Information on area of interest

   - Graphical

2. Mission requirements and objectives

   - Combination textual/graphical

3. Own aircraft position, altitude, heading and speed

   - Combination textual/graphical

4. Relative orientation of aircraft and camera

   - Graphical

Action Required:

1. Perform visual inspection or monitoring function

   - Visual activity

2. Record information manually

   - Writing tools

   - Keyboard

3.
4.

Feedback Required:

1. None

   - Not applicable

2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Report Terrain Features

Task Description: The operator briefs the other crew members on the significant features of the terrain in the vicinity of the contact of interest. The briefing includes information on the suitability of the terrain for insertion of SAR Techs to the rescue site.

Task Completion Times:

10-30 sec - Infrequent

Initiating Conditions:

1. A position of interest has been identified
2. The terrain features in a particular area have been determined
3.

Decision Required:

Decisional Rating Nine: This task includes a visual, auditory, or psychomotor component, with only insignificant decisional aspects to any cognitive

Information Required:

1. Details on terrain features in area of interest

   - Graphical

   - Memory
2.
3.
4.

Action Required:

1. Speak

   - Mental processing activity
2.
3.
4.

Feedback Required:

1. Verbal acknowledgement

   - Verbal
2.
3.

Task: Receive Direction to Conduct Off Task Checks

Task Description: The operator receives direction from another crew member to conduct the Off Task checks.

Task Completion Times:

3-10 sec - Very infrequent

Initiating Conditions:

1. None
2.
3.

Decision Required:

Decisional Rating Ten: This task includes a visual, auditory, or psychomotor component, with no decisional aspects to any cognitive content.

Information Required:

1. None

   - Not applicable
2.
3.
4.

Action Required:

1. Listen and interpret information

   - Mental processing activity
2.
3.
4.

Feedback Required:

1. None

   - Not applicable
2.
3.

ANNEX D- AIMS GROSS TASK ANALYSIS RESULTS

Task: Unload AIMS Recorder

Task Description: The operator removes the video tape from the recorder and annotates it with mission information as required. It is then stowed in a secure facility for the transit and landing phase of the mission.

Task Completion Times:

30-60 sec - Infrequent

Initiating Conditions:

1. There is no longer a need to record video imagery

2.

3.

Decision Required:

Decisional Rating Eight: This task includes a visual, auditory, or psychomotor component, with only minor decisional aspects to any cognitive content

Information Required:

1. Mission-related information to identify the tape

- Textual (alphanumeric)

- Memory

2.

3.

4.

Action Required:

1. Manipulate control, equipment or objects

- Continuous displacement control (e.g. joystick, mouse, trackball, light pen)

2. Record information manually

- Writing tools

- Keyboard

3.

4.

Feedback Required:

1. Visual indication of equipment status

- Indicator light (on/off)

- Visual message/alert

2.

3.

List of symbols/abbreviations/acronyms/initialisms

AAP	Allied Administrative Publications
AAW	Anti-Air Warfare
AC	Aircraft Commander
ACU	Aircraft Control Unit
ADF	Automatic Direction Finder
AECM	Aeromedical Evacuation Crew Member
AESOP	Airborne Electronic Sensor Operator
AFCS	Automatic Flight Control System
AIMP	Aurora Incremental Modernization Program
AIMS	Advanced Integrated Multi-sensor Surveillance
ALBEDOS	Airborne Laser Based Enhanced Detection and Observation System
AM	Amplitude Modulated
ANVIS	Aviator Night Vision Imaging System
APU	Auxiliary Power Unit
ASL	Above Sea Level
ASO	Acoustic Sensor Operator
ASW	Anti-Submarine Warfare
ASuW	Anti-Surface Warfare
ATC	Air Traffic Control
ATIS	Automatic Terminal Information System
AWACS	Airborne Warning and Control System

AWW	Above Water Warfare
CASARA	Civil Air Search and Rescue Association
CCG	Canadian Coast Guard
CCGA	Canadian Coast Guard Auxiliary
CF	Canadian Forces
CFB	Canadian Forces Base
COI	Contact of Interest
COSPAS	Cosmicheskaya Sistyema Poiska Avariynich Sudov
CMDS	Counter Measure Dispensing System
CRATT	Covered Radio Teletype
CTG	Canadian Task Group
DCIEM	Defence and Civil Institute of Environmental Medicine
DF	Direction Finding
DFO	Department of Fisheries and Oceans
DICASS	Directional Command Active Sonobuoy System
DIFAR	Directional Frequency Analysis and Ranging
DME	Distance Measuring Equipment
DND	Department of National Defence
DTM	Data Transfer Module
ELT	Electronic Locator Transmitter
ELVISS	Enhanced Low-Light Level Visible and InfraRed Surveillance System
EO	Electro Optic
ESM	Electronic Support Measures
ETA	Estimated Time of Arrival

FAC	Foreign Affairs Canada
FE	Flight Engineer
FFD	Function Flow Diagrams
FISHPAT	Fisheries Patrol
FLIR	Forward Looking Infrared
FM	Frequency Modulated
FMS	Flight Management System
FO	First Officer
FOL	Forward Operating Location
FOV	Field of View
FPB	Fast Patrol Boat
FSP	Federal Search and Rescue Program
FTP	Fly to Point
FWSAR	Fixed Wing Search and Rescue
GMTI	Ground Moving Target Indicator
GPDC	General Purpose Digital Computer
GPMG	General Purpose Machine Gun
GPS	Global Positioning System
HALE	High Altitude Long Endurance
HDS	Helicopter Delivery Service
HF	High Frequency
HFE	Human Factors Engineering
ICAO	International Civil Aviation Organization
ICS	Intercommunications System

ICSAR	Interdepartmental Committee on Search and Rescue
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules
IGE	In-Ground-Effect
ILS	Instrument Landing System
IMO	International Maritime Organization
INS	Inertial Communication System
IP	Intercept Point
IR	Infrared
IRCM	Infrared Counter Measures
ISAR	Inverse Synthetic Aperture Radar
ISR	Intelligence Gathering, Surveillance, and Reconnaissance
JRCC	Joint Rescue Co-ordination Centre
JSS	Joint Supply Ship
KIAS	Knots Indicated Air Speed
LF	Land Forces
LLLTV	Low Light Level Television
LM-SAR	Lead Minister for SAR
MAD	Magnetic Anomaly Detector
MAWS	Missile Approach Warning System
MCM	Mine Counter-Measures
MDMS	Mission Data Management System
MFTA	Mission, Function, Task Analysis
MH	Maritime Helicopter

MLA	Mean Line of Advance
MOAT	Maritime Operational Aircrew Training
MOB	Main Operating Base
MP&EU	Maritime Proving and Evaluation Unit
MPAS	Mission Preparation and Analysis System
MPCC	Maritime Patrol Crew Commander
MRS	Maintenance Record Set
MRSC	Maritime Rescue Sub-Centre
NASO	Non Acoustic Sensor Operator
NATO	North Atlantic Treaty Organization
NAVCOM	Navigator Communicator
Nav/SensO	Navigator/Sensor Operator
NIF	New SAR Initiatives Fund
NOCL	Notice of Crash Location
NORAD	North American Aerospace Defense Command
NOTAM	Notice to Airmen
NSP	National Search and Rescue Program
NSS	National Search and Rescue Secretariat
NVGs	Night Vision Goggles
OEM	Original Equipment Manaufacturer
OGD	Other Government Department
OGE	Out-of-Ground-Effect
OJT	On-the-Job Training
OMI	Operator Machine Interface

OSC	On-Scene Commander
OTC	Officer in Tactical Command
OTHT	Over The Horizon Targeting
OUT	Operational Training Unit
OUT	Operational Training Unit
PFI	Pre-Flight Inspection
PLB	Personal Locator Beacon
PLE	Prudent Limit of Endurance
PS	Professional Services
RCC	Rescue Coordination Centre
RCMP	Royal Canadian Mounted Police
RECCE	Reconnaissance
RMP	Recognized Maritime Picture
ROE	Rules of Engagement
RWR	Radar Warning Receiver
SAC	Scene of Action Commander
SAM	Surface-to-Air Missile
SAR	Search and Rescue
SARPAL	SAR Palletized
SARSAT	Search And Rescue Satellite-Aided Tracking
SCDS	Stores Control and Dispensing System
SDS	Self Defence System
SENSO	Sensor Operator
SIF	Selective Identification Feature

SITREP	Situation Report
SKAD	Survival Kit, Air Droppable
SM	Searchmaster
SME	Subject Matter Expert
SOI	Statement of Operating Intent
SOLAS	Safety of Life at Sea
SOR	Statement of Operational Requirements
SPS	Self Protection System
SRR	Search and Rescue Region
SRS	Sonobuoy Reference System
SRU	Search and Rescue Unit
SSC	Surface Surveillance and Control
SSM	Surface-to-Surface Missile
SSSC	Subsurface Surveillance and Control
TACAN	Tactical Air Navigation
TACNAV	Tactical Navigator
TAS	True Air Speed
TDP	Technology Demonstration Program
UHF	Ultra High Frequency
UWW	Under Water Warfare
VERTREP	Vertical Replenishment
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omni-directional Radio

WOPS	Wing Operations

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3. TITLE (The complete document title as indicated on the title page. Its classification is indicated by the appropriate abbreviation (S, C, R, or U) in parenthesis at the end of the title)

Advanced Integrated Multi−sensor Surveillance (AIMS) − Mission, Function, Task Analysis (U)

4. AUTHORS (First name, middle initial and last name. If military, show rank, e.g. Maj. John E. Doe.)

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5. DATE OF PUBLICATION (Month and year of publication of document.)	6a NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.)	6b. NO. OF REFS (Total cited in document.)
June 2007	238	28

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Contract Report This document supports DRDC Atlantic CR2006−242 (Advanced Integrated Multi−sensor Surveillance (AIMS) − Operator Machine Interface (OMI) Definition Study)

8. SPONSORING ACTIVITY (The names of the department project office or laboratory sponsoring the research and development − include address.)

Sponsoring: National Search &Rescue Secretariat, 400−275 Slater Street, Ottawa, Ontario K1A 0K2
Tasking: DRDC Atlantic
DRDC Valcartier

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant under which the document was written. Please specify whether project or grant.) 3373AO/13dx	9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.) W7711−4−7904/01−TOR
10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document) DRDC Atlantic CR 2007−021	10b. OTHER DOCUMENT NO(s). (Any other numbers under which may be assigned this document either by the originator or by the sponsor.)

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(U) To increase the effectiveness of searching, detecting, classifying, and identifying contacts particularly at night and in poor weather, the Advanced Integrated Multi−sensor Surveillance (AIMS) system is being developed. The AIMS system is advanced through the integration of four sensors into a single gimbal. As such, the system will support a myriad of missions for both the CP−140 and Fixed Wing Search and Rescue (FWSAR) communities, including timely search and rescue (SAR) response, maritime operations, and ground surveillance in support of the Land Forces (LF). To ensure optimal performance, the AIMS system requires an appropriate interface and controls, the design of which must provide effective interaction between the operator and the technological capability of the system. This document, prepared by CAE Professional Services on behalf of Defence R&D Canada (DRDC), presents results stemming from the mission, function, and task analysis of the activities associated with employing the AIMS system on the FWSAR and AIMP CP−140 platforms to support the conduct of SAR and ground surveillance missions respectively. This data will be used to support the design of an Operator Machine Interface (OMI) for the AIMS system.

(U) Le système perfectionné de surveillance multi−capteurs intégré (AIMS) est mis au point dans le but d'accroître l'efficacité de la recherche, de la détection, de la classification et de l'identification des contacts, en particulier la nuit et dans de mauvaises conditions météorologiques. Il s’agit d’un système évolué fondé sur l'intégration de quatre capteurs dans un seul cardan. Il contribuera à toute une gamme de missions du CP 140 et de l'aéronef à voilure fixe pour la recherche et sauvetage (FWSAR), y compris l'intervention de recherche et sauvetage (SAR) en temps opportun, les opérations maritimes et la surveillance au sol à l'appui de la Force terrestre (FT). Dans le but d'optimiser la performance, le système AIMS a besoin d'une interface et de commandes appropriées, dont la conception doit permettre une interaction efficace entre l'opérateur et la capacité technique du système. Le présent document, préparé par CAE Services professionnels au nom de R & D pour la défense Canada (RDDC), présente les résultats d'une analyse de missions, de fonctions et de tâches (MFTA) des activités associées à l'emploi du système AIMS à bord du FWSAR et de la plate−forme CP 140 du Programme de modernisation progressive de l'Aurora (PIMPA) à l'appui de la conduite d'opérations SAR et de missions de surveillance au sol. Ces données viendront à l'appui de la conception d'une interface opérateur−machine (IOM) pour le système AIMS.

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(U) search, rescue, maritime patrol, surveillance, operator,

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